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The opinions expressed in this document are those of the various authors and/or compilers. They do not necessarily represent the views of the Workshop Committee, ATNESA, DGIS or the other organisations supporting the workshop

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Animal Traction Network for Eastern and Southern Africa (ATNESA)

Donkey Bibliography

**Bibliography of published works
containing information on donkeys (*Equus asinus*)**

Prepared for the ATNESA workshop on

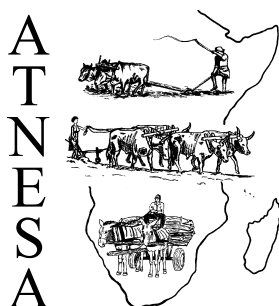
Improving donkey utilisation and management

5-9 May 1997, Debre Zeit, Ethiopia

Compiled by

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1997



*Document preparation supported by
Directorate General for Development Cooperation (DGIS), The Netherlands*

Introduction and acknowledgements

This bibliography was prepared for the participants of the ATNESA workshop on *Improving donkey utilisation and management* held 5-9 May 1997 at Debre Zeit, Ethiopia. This is an initial draft of a more complete bibliography that will be finalised after the workshop. The final bibliography will have more entries and will be indexed. It is intended to publish the bibliography as a printed document and make it available as a searchable database. The information will also be published in a suitable form on the Internet.

At this stage, it is not possible to direct readers to a single source of these documents. Many can be traced through libraries, but it is acknowledged that some important documents are not readily available in this way. It is hoped that ATNESA, or one of its partner organisations, may be able to assist people to obtain important documents in the future. At present, people are advised to trace documents through libraries or the publishing organisations.

Workshop participants and other colleagues are asked to comment on the form of this document and add further references. Acknowledgement for such assistance will be included in the preface of the subsequent edition(s). It would be helpful if people supplying references could also submit a photocopy of the relevant paper/publication to one of the two compilers.

The present selection of documents, the categories and the classifications are all provisional. They are likely to be modified in the light of comments. It is recognised that some publications have more relevance to ATNESA members than others. The compilers stress that this is not yet a comprehensive bibliography. Many publications relating to donkeys could not be included in this first selection.

The compilers would like to stress that the inclusion of a publication in this bibliography should not be construed as a recommendation or endorsement. The compilers do not necessarily agree with the content or conclusions of the publications cited.

The references and annotations have been prepared by Pamela Mueller and Paul Starkey, with assistance from Malcolm Starkey. Dr Mueller has been working at Cornell University for several years, but is now based at the University of California, Los Angeles. Desk-top publishing was carried out by Paul Starkey and Malcolm Starkey. Funds for this series of workshop readers were provided by Directorate General for Development Cooperation (DGIS), The Netherlands. To all these individuals and organisations, a grateful thank you.

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General works

- Agrifacts, 1987. Using donkeys for draught power. Part 1: Principles of animal draught. Part 2: Donkey management. Part 3: Harnesses for donkeys. Part 4: Hitches for donkeys. Agricultural Information Services, P/Bag 003, Gaborone, Botswana.
- Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9
- Benoit A, L’Ane, dressage, élevage. pp 29–30 in: L’âne: aspects historiques, culturels, zootechniques. *Ethnozootechnie* 37. Société d’Ethnozootechnie, 25 Boulevard Arrago, 75013 Paris, France. ISBN 2-901081-20-7
- Berry C and Kokas J-A, 1989. *Donkey Business II. A Guide for Raising, Training and Showing Donkeys*. Off and Running Print Management. ISBN 0-7316-6088-9
Book covers many topics from the Australian perspective, including extensive information on training, care, feeding, breeding of donkeys, care of the foal, vaccinations and first aid, conformation, equipment and harnesses, use of donkeys for disabled riding, for training calves and as livestock guards.
- Borwick R, 1970. *Donkeys*. Cassell, London, UK.
- Dent A, 1972. *Donkey: the story of the ass from east to west*. George Harrap, London. 175p. ISBN 0 245 59932 0.
- Fielding D and Pearson R A, 1992. Power to the women: are donkeys an overlooked option? *ILEIA Newsletter* 3/92: 18–19
- Fielding D and Pearson R A 1990 (eds). *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6th September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Flamant J C, Gibon A and Casabianca F, 1995. Adjustment of animal populations to economic and social evolutions: An essay on the flexibility capacity of animals. pp. 15–24 in : Flamant J C et al (eds). EAAP Publication No. 74. *Animal production and rural tourism in Mediterranean regions*. Wageningen Pers: Wageningen, The Netherlands. ISBN 90-74134-31-9.
- Gupta A K, Varshney J P and Uppal P K, 1994. Comparative studies on biochemical indices in different breeds of equines. *Indian Veterinary Journal* 71 (1): 26–30.
Activities of SGOT, SGPT and AT, as well as concentrations of albumin, cholesterol, BUN, creatinine and chloride were compared in Indian, Italian and Poitu donkeys and Thoroughbred vs. Kathiawari horses. Most metabolite concentrations were lower in donkeys than in horses (except chloride ion); Thoroughbreds differed from Kathiawari horses.
- Hutchins B and Hutchins P, 1981. *The Definitive Donkey. A Textbook on the Modern Ass*. Hee Haw Book Service, Denton, Texas, USA.
Book describing donkey breeds, conformation, care and feeding, breeding and reproduction, anatomical differences between horses and donkeys, harnesses and equipment, training and use of donkeys.
- Laurans R, 1986. L’image populaire de l’Ane. pp 59–72 in: L’âne: aspects historiques, culturels, zootechniques. *Ethnozootechnie* 37. Société d’Ethnozootechnie, 25 Boulevard Arrago, 75013 Paris, France. ISBN 2-901081-20-7
- Lumsden S, 1993. Mechanisation endangers the venerable donkey. *Ceres* 143 25(5): 10–13
- Prentis R A, 1994. Issues for working equines (Keynote address). pp 9–16 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut

- Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9
- Svendsen E D, 1988. *A passion for donkeys*. David and Charles, Newton Abbot and The Donkey Sanctuary, Devon, UK. 208p. ISBN 0715392522.
- Svendsen E D, 1991. Work to improve the conditions of donkeys and mules worldwide. pp 181–184 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Svendsen E D (ed), 1989. *The Professional Handbook of the Donkey, 2nd Edition*. The Donkey Sanctuary, Devon, UK
- Chapters by individual authors on housing and care, nutrition, parasites, general medical, foot care, breeding, riding, equipment, showing the donkey, donkeys in disabled riding programs, origin of donkeys, pasture management, behaviour, donkeys as draft animals.

General works - Africa

- Aganga A A and Maphorisa K, 1994. Characteristics and uses of donkeys in Botswana. pp 146–149 in: Starkey P, Mwenya E and Stares J (eds), *Improving Animal Traction Technology*, Proceedings of the first workshop of the Animal Traction Network for Eastern and Southern Africa (ATNESA), 18–23 Jan 1992, Lusaka, Zambia. Technical Centre for Agricultural and Rural Cooperation, Wageningen, The Netherlands. (ISBN 92-9081-127-7)
- A survey of 120 donkeys in Botswana gives weights and body dimensions of donkeys in this region. Average body weight was 140 kg for males, 139 kg for females. Average height at the withers: males 113 cm, females 109 cm. Aspects of donkey use, management and nutrition are discussed.
- Betker J and Kutzbach H D, 1991. The role of donkeys in agricultural mechanisation in Niger – potential and limitations. pp 223–230 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Cochin J, 1995. L'âne au Sénégal et au Burkina Faso. *Ethnozootechnie* **56**: 5–26. Société d'Ethnozootechnie, 25 Boulevard Arrago, 75013 Paris, France.
- Diop A T, 1989. *L'utilisation de la traction asine pour la fauche des parcours naturels*. Institut Sénégalais de Recherches Agricoles, BP 2057, Dakar, Senegal.
- Fielding D, 1988. Donkeys in Africa. pp 85–100 in Stone T C (ed) *Animals in Africa*. Aberdeen University African Studies Institute, Aberdeen, UK.
- Feseha Gebreab, 1992. Horses, donkeys and mules in Ethiopia: role in agricultural development and major problems. pp 102–109 in: *Proceedings of the Cairo international meeting on working animals*, held 13–16 April 1992, Cairo, Egypt. World Association for Transport, Animal Welfare and Studies, Hardwick Court Farm, Hardwick Lane, Chertsey, KT16 0AD, UK. 208p.
- Jones P A, 1991. Overcoming ignorance about donkeys in Zimbabwe - a case study. pp 311–318 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Kumwenda W and Mateyo L, 1991. The potential and utilisation of the donkey in Malawi. pp 28–32 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990,

- Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Mohammed Abdella and Teketel Porssido, 1992. Preliminary study on the status of donkeys in Awassa Woreda, Ethiopia. pp 92-101 in: *Proceedings of the Cairo international meeting on working animals*, held 13–16 April 1992, Cairo, Egypt. World Association for Transport, Animal Welfare and Studies, Hardwick Court Farm, Hardwick Lane, Chertsey, KT16 0AD, UK. 208p.
- Mohammed A, 1991. Management and breeding aspects of donkeys around Awassa, Ethiopia. pp 185–188 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Starkey P, 1995. The donkey in South Africa: myths and misconceptions. pp 139–151 in: Starkey P (ed) *Animal traction in South Africa: empowering rural communities*. Development Bank of Southern Africa, PO Box 1234, Halfway House, Gauteng, South Africa. 159p. ISBN 1-874878-67-6
- Starkey P, 1994. Animal power in South Africa: some social and technological issues. pp 49–65 in: *Technology for rural livelihoods: current issues for engineers and social scientists*. Proceedings of a workshop held 6–7 September 1994 at the Natural Resources Institute, UK. Overseas Development Administration, London, UK. 100p.
- Starkey P, 1994. Donkey utilisation in sub-Saharan Africa: recent changes and apparent needs. pp 289–302 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9
- Sumberg J and Gilbert E, 1992. Agricultural Mechanisation in The Gambia: Drought, donkeys and minimum tillage. *African Livestock Research* **1**: 1–10.
- Twerda M B C, 1995. A survey of donkey use by Rendille camel pastoralists in Northern Kenya. *Draught Animal News* **22**: 14–19
- Twerda M B C, 1994. The role of donkeys in Samburu and Turkana society. MSc thesis, Centre for Tropical Veterinary Medicine, University of Edinburgh, UK
- Wilson R T, 1991. Equines in Ethiopia. pp 33–47 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Wilson R T, 1981. Distribution and importance of the domestic donkey in circumsaharan Africa. *Singapore Journal of Tropical Geography* **2** (2). ISSN 0129-7619
Presents data on donkeys and their potential as an economic force, indicating their importance in the world at large and in circumsaharan Africa in particular; discusses contributions of donkeys to the economies of undeveloped societies and their future potential, using case studies from Ethiopia, Sudan and Mali.
- Wilson R T, 1978. Studies on the livestock of southern Dafur, Sudan VI. Notes on equines. *Tropical Animal Health and Production* **10**: 183–189.

General works - Asia

- Jest C and Ravis-Giordani G, 1986. L'Ane au Tibet. pp 15–20 in: L'ane: aspects historiques, culturels, zootechniques. *Ethnozootechnie* **37**. Société d'Ethnozootechnie, 25 Boulevard Arrago, 75013 Paris, France. ISBN 2-901081-20-7

Ramachandran S and Srinivas R P, 1991. The contribution of the donkey and pony to the economy of rural low-income groups in Karnataka state, South India (poster). pp 13–14 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

General works - Europe

Lietaud M, 1986. L'Ane-jupon de Gignac. pp 73–76 in: L'ane: aspects historiques, culturels, zootechniques. *Ethnozootehnie* **37**. Societé d'Ethnozootehnie, 25 Boulevard Arrago, 75013 Paris, France. ISBN 2-901081-20-7

Pujol R, 1986. L'Ane chez les folkloristes français: étude bibliographique. pp 77–80 in: L'ane: aspects historiques, culturels, zootechniques. *Ethnozootehnie* **37**. Societé d'Ethnozootehnie, 25 Boulevard Arrago, 75013 Paris, France. ISBN 2-901081-20-7

Reveleau L, 1986. Les course asines en Vendée. pp 31–36 in: L'ane: aspects historiques, culturels, zootechniques. *Ethnozootehnie* **37**. Societé d'Ethnozootehnie, 25 Boulevard Arrago, 75013 Paris, France. ISBN 2-901081-20-7

General works - Latin America

Aluja A S de and Lopez F, 1991. Donkeys in Mexico. pp 1–7 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

Rodriguez-Maldonado, G 1991. The principle problems in working donkeys in Mexico (abstract). pp 138–139 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

Sims B G and Maldonado S J, 1991. Donkeys and other equines in Mexican agriculture. pp 8–12 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

Anatomy

Alexander R M and Dimery N J, 1985. Elastic properties of the forefoot of the Donkey, *Equus asinus*. *Journal of Zoology* **205**: 511–524.

Bianchi M, 1989. The thickness, shape and arrangement of elastic fibers within the nuchal ligament from various animal species. *Anatomischer Anzeiger* **169** (1): 53–66.

The thickness of the elastic fibers of the nuchal ligament is unrelated to the size of the animal but is determined by taxonomic constraints, with ruminants having thicker fibers than equids or carnivores. Structural changes occurring during early postnatal growth are described.

Dimery N J and Alexander R M, 1985. Elastic properties of the hind foot of the Donkey, *Equus asinus*. *Journal of Zoology* **207**: 9–20.

Kotze S H, 1988. The arrangement of the muscle layers at the equine ileocecal junction. *Journal of the South African Veterinary Association* **59** (2): 67–72.

Muscle layers of the ileocaecal junctions of horses, zebras and a donkey were examined and described. Finding support the view that the sphincteroid action of the circular and semicircular muscle layers is

inefficient and additional closing mechanism of vascular origin may be required at the ileocaecal papilla of the equid.

- Kotze S H and Soley J T, 1990. Scanning electron and light microscopy of the mucosa of the equine ileocecal junction. *Onderstepoort Journal of Veterinary Research* **57** (1): 19–24.

The ileocecal junction mucosal surface morphology of 5 horses and 1 donkey was examined and is described in detail.

- Misk, N, Guindy M H and Makaldy F M, 1984. Venous diverticulum at the intermandibular space in a donkey. *Equine Practice* **6** (9): 31–32.

Case report from Egypt of a four-year-old female donkey with a venous diverticulum in the intermandibular space. Surgery is described, and photographs and a radiograph are included.

- Simoens P, De-Geest J P and Lauwers H, 1996. Comparative morphology of the pectinate ligaments of domestic mammals, as observed under the dissecting microscope and the scanning electron microscope. *Journal of Veterinary Medical Science* **58** (10): 977–982.

The pectinate ligaments of horses, donkeys, oxen, sheep, goats, dogs, cats, pigs and rabbits were studied and compared. In equids, the pectinate ligament was prominent and characterized by sturdy interconnected strands and relatively small intertrabecular spaces. The structure in ruminants and carnivores differed from that of equids and from each other.

Behaviour

- Flato L, Houpt K and Brozowski C, 1989. The behavior of feral donkeys (*Equus asinus*) in captivity. *Etologia* **1**: 97–102.

- French J M, 1993. Assessment of donkey temperament and the influence of home environment. *Applied Animal Behaviour Science* **36** (2-3): 249–257.

The temperament of individual donkeys being sent to foster homes from the Donkey Sanctuary (UK) was evaluated with a calibrated-line rating method using 8 pairs of contrary adjectives to describe traits, e.g. calm-nervous. Donkeys' attitude towards people and other animals was recorded. Factor analysis produced the factors "obduracy" and "vivacity", levels of which could help describe a donkey's potential friendliness or lack thereof towards humans and dogs.

- Klingel H, 1971. A comparison of the social behaviour of the Equidae. Pp 124–132 in: Geist V and ? (eds) *Behavior of Ungulates and its relationship to Management*

Breeds

- Cubeddu G M, Bini P P, Floris B, Carcangiu V, Bomboi G and Pintori G, 1991. Blood constants in the white donkey on the island of Asinara. *Bollettino Societa Italiana Biologia Sperimentale* **67** (6): 577–584.

30 blood parameters were evaluated in 14 albino donkeys over a period of 4 months. No significant differences from other donkey breeds were found.

- Pinna W, Cappio-Borlin A, Vacca G M and Lai G, 1993. Morphology of adult white donkeys of Asinara. *Bollettino Societa Italiana Biologia Sperimentale* **69** (10): 595–600.

Describes the phenotype (color, eyes, bone structure, musculature, frame size) of the Asinara white donkey.

- Roca M I C, Pinheiro L E L and Guimaraes S E F, 1994. Characterization of the karyotype of Pega donkeys. *Arquivo Brasileiro de Medicina Veterinaria e Zootecnia* **46** (6):647–663.

The karyotype of the donkey was characterized by means of morphological comparisons and standards of chromosomal banding GTC, CBG and NOR, using 30 Pega donkeys from Brazil. Results are compared with previous literature values for donkeys and horses.

Culture, folklore and traditions

- Rousseau M, 1986. L'Ane et ses thèmes dans l'art. pp 37–58 in: L'ane: aspects historiques, culturels, zootechniques. *Ethnozootchnie no 37*. Société d'Ethnozootchnie, 25 Boulevard Arrago, 75013 Paris, France. ISBN 2-901081-20-7
- Van Snick G, 1995. Animals and traditional local holidays in Belgium. pp. 159–163 in : Flamant J C et al (eds). EAAP Publication No. 74. *Animal production and rural tourism in Mediterranean regions*. Wageningen Pers: Wageningen, The Netherlands. ISBN 90-74134-31-9.

Demographics

- Fielding D, 1991. The number and distribution of equines in the world (poster). pp 62–66 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Fielding D, 1986. Tropical Equine Project: Preliminary equine survey in Africa. *Draught Animal News* **6**: 18-19.
- Spindler F, 1986. Evolution de la population asine française. pp 21–28 in: L'ane: aspects historiques, culturels, zootechniques. *Ethnozootchnie* **37**. Société d'Ethnozootchnie, 25 Boulevard Arrago, 75013 Paris, France. ISBN 2-901081-20-7

Evolution and Domestication

- Chopineau M and Stewart F, 1996. Cloning and analysis of the cDNA for the common alpha-subunit of the donkeys pituitary glycoprotein hormones. *Journal of Molecular Endocrinology* **16** (19): 9–13.
- Reverse transcription-PCR was used to clone the coding region of the donkey glycoprotein hormone alpha-subunit transcript from pituitary gland RNA. The sequence demonstrated 97% identity with the horse at the nucleotide level, confirming the very close evolutionary linkage between these two species. Donkey and horse alpha-subunit has unusual C-terminus compared to other mammals. Findings provide a possible partial explanation for the unique biological properties of the equine gonadotrophins.
- Clutton-Brock J, 1992. *Horse power: a history of the horse and the donkey in human societies*. Harvard University Press, Cambridge, Massachusetts, USA. 192p. ISBN 0-674-40646-X
- Bodson L, 1986. L'utilisation de l'Ane dans l'antiquité gréco-romaine. pp 7–14 in: L'ane: aspects historiques, culturels, zootechniques. *Ethnozootchnie* **37**. Société d'Ethnozootchnie, 25 Boulevard Arrago, 75013 Paris, France. ISBN 2-901081-20-7
- Bökönyi S, 1991. The earliest occurrence of domestic asses in Italy. In: *Equids in the Ancient World*, Volume II. eds. R.H. Meadow and H.P. Uerpmann pp. 178-216. Wiesbaden: Ludwig Reichert.
- Eisenmann V, 1995. L'Origine des ânes: questions et réponses paléontologiques. *Ethnozootchnie* **56**: 5–26. Société d'Ethnozootchnie, 25 Boulevard Arrago, 75013 Paris, France.
- Epstein H, 1984. Ass, mule and onager. pp. 174–184 in Mason I L (ed) *Evolution of Domesticated Animals*. Longman, London, UK.
- Grigson C, 1993. The earliest domestic horses in the Levant? New finds from the fourth millennium of the Negev. *Journal of Archaeological Science* **20** (6): 645–655.

- Groves C P, 1966. Taxonomy. pp 2–11 in: Groves C P, Ziccardi F and Toschi, A (eds) *Sull'Asino Selvatico Africano*. Supplement to *Ricerche di Zoologia Applicata alla Caccia*, Volume 5, 1.
- Groves C P, 1986. The Taxonomy, Distribution and Adaptations of Recent Equids. pp 11–51 in: Meadow R H and Uerpman H P (eds) *Equids in the Ancient World*. Wiesbaden: Ludwig Reichert.
- Poplin F, 1986. Buffon et l'origine de l'Ane aux origines de l'évolutionnisme. pp 3–6 in: L'ane: aspects historiques, culturels, zootechniques. *Ethnozootecnie* **37**. Société d'Ethnozootecnie, 25 Boulevard Arrago, 75013 Paris, France. ISBN 2-901081-20-7
- Xu X, Gullberg A and Arnason U, 1996. The complete mitochondrial DNA (mtDNA) of the donkey and mtDNA comparisons among four closely related mammalian species-pairs. *Journal of Molecular Evolution* **43** (5): 438–446.
The nucleotide sequence of the complete mitochondrial genome of the donkey was determined (16, 670 bp with pronounced heteroplasmy caused by variable numbers of two types of repetitive motifs in the control region). The mtDNA differences between horses and donkeys (3.5 to 9.4% for different genes) suggest that the evolutionary separation of the two species occurred approximately 9 million years ago. Comparisons of other species pairs, however (harbour seal/grey seal, fin whale/blue whale, human/chimpanzee) caution that superimposition of sequence data of one lineage for resolving and dating evolutionary divergences of other lineages should be performed with caution unless based on comprehensive data.
- Xu X, Janke A and Arnason U, 1996. The complete mitochondrial DNA sequence of the greater Indian rhinoceros, *Rhinoceros unicornis*, and the phylogenetic relationship among Carnivora, Perissodactyla and Artiodactyla (+ Cetacea). *Molecular Biology and Evolution* **13** (9): 1167–1173.
The sequence of the complete mitochondrial genome of the rhinoceros was determined and compared to other Perissodactyls (equids) and other mammalian species. Phylogenetic analysis grouped Carnivora, Perissodactyla and Artiodactyla (+Cetacea) into a superordinal clade and within this clade a sister group relationship was recognized between Carnivora and Perissodactyla to the exclusion of Artiodactyla (+Cetacea). The evolutionary divergence between the families Rhinocerotidae and Equidae was dated to approximately 50 million years ago.

Feral and free-ranging donkeys

- Bayliss P and Yeomans K M, 1989. Distribution and abundance of feral livestock in the top end of the Northern Territory, Australia, 1985-1986 and their relation to population control. *Australian Wildlife Research* **16** (6): 651–676.
Feral and domestic stock (buffalo, cattle, horses and donkeys) were censused by fixed-wing aerial survey over 16% of the Northern Territory in March-April 1985. Numbers and habitat distribution of the different species is given. Donkeys were found in 3 discrete pockets in dry woodland, with their number estimated at 29,400, at an average density of .13 per square km.
- Bayliss P and Yeomans K M, 1989. Correcting bias in aerial survey: Population estimates of feral livestock in Northern Australia using the double-count technique. *Journal of Applied Ecology* **26** (3): 925–934.
The suitability of the double-count technique for estimating populations of feral livestock derived by multispecies aerial survey was examined and is discussed. Effect of habitat and species on count accuracy is discussed. The validity of the double-count technique for correcting aerial survey bias in population estimates of donkeys and buffalo in woodland was tested by removal experiments and found to be accurate.
- Boyles J S, ? Managing America's Wild Horses and Burros. *Equine Veterinary Science* **6**: 261–265.
- McKnight T L, 1958. The feral burro in the United States: distribution and problems. *Journal of Wildlife Management* **22**: 163–179.

Woirnarski J C Z, 1992. A survey of the wildlife and vegetation of Purnululu Bungle Bungle National Park and adjacent area. *Western Australia Department of Conservation and Land Management Research Bulletin* 0 (6) I-IX: 1–140.

Results of a 10 week biological survey of Purnululu National Park, Purnululu Conservation reserve and adjacent areas in 1989. Plant and animal species of the area are listed. Habitat of the area, especially riparian and lowland, has been degraded by domestic and feral livestock, particularly donkeys and cattle, posing an environmental threat to native small mammals, several of whom have recently become extinct in the area.

Harnesses

Bock S, 1988. Donkey harness informal survey. Department of Agricultural Research, Ministry of Agriculture, Gabarone, Botswana.

Dibbits H J, 1991. Harnessing systems for donkeys - experiences from Kenya. pp 266–274 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

Dibbits H J, 1985. The donkeys' formidable role in agriculture. *Kenya Farmer*. ISSN 0023-0421

Suggests that with proper harnessing donkeys can be used for farming operations like plowing and weeding instead of simply as pack animals or to pull carts. Stresses the importance of a well-fitting collar. Describes the UNIDIB donkey harness which has proved very efficient in Kenya and whose design will be simplified so that it can be produced at low cost at village level.

Dibbits H J, 1985. UNIDIB donkey harness. *Draught Animal News* 4: 16–17

Froese C, 1980. *Harness project report*. Centre for Tropical Veterinary Medicine, Easter Bush, Rosilin, Edinburgh, UK.

Jones P, 1994. A note on donkey harnessing problem and innovation in Zimbabwe. pp 426–427 in: Starkey P, Mwenya E and Stares J (eds), *Improving Animal Traction Technology*, Proceedings of the first workshop of the Animal Traction Network for Eastern and Southern Africa (ATNESA), 18–23 Jan 1992, Lusaka, Zambia. Technical Centre for Agricultural and Rural Cooperation, Wageningen, The Netherlands. (ISBN 92-9081-127-7)

Outlines the problem of using two-wheeled, poorly balanced carts with two donkeys harnessed with an ox yoke. Describes a new method of harnesses donkeys to a cart using breast bands over both the breast and the rump (the latter to act as breeching), as well as swingle trees and eveners. This harness is cheap, easy to make and should improve performance, but has not yet been tested by farmers.

Krause P, 1995. Harnessing donkeys for cart work. *Draught Animal News* 19: 19–22.

Krause P, 1994. Harnessing techniques for donkeys used to draw carts. pp 213–230 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9

Krause P, 1993. An assessment of suitable harnessing techniques for donkeys used to draw carts. MSc Thesis, Centre for Tropical Veterinary Medicine, University of Edinburgh, UK.

Mueller P M, Jones M T and Hintz H F, 1992. Physiological responses of donkeys performing draft with different harness types. pp 171–174 in: *Proceedings of the Cairo international meeting on working animals*, held 13–16 April 1992, Cairo, Egypt. World Association for Transport, Animal Welfare and Studies, Hardwick Court Farm, Hardwick Lane, Chertsey, KT16 0AD, UK. 208p.

- Ogweno S and Oudman L, 1990. *Step-by-step guide to making collar harnesses: a manual for construction of the ox and donkey collar harnesses*. University of Nairobi, College of Agriculture and Veterinary Sciences, Nairobi, Kenya.
- Oudman L, 1996. Challenges to the use of donkeys in Kenya. pp 32–33 in: KENDAT (eds) *Meeting the challenges of draught animal technologies in Kenya*, proceedings of the second KENDAT national workshop held March 1995, Karen, Kenya. Kenya Network for Draught Animal Technology, c/o Department of Agricultural Engineering, University of Nairobi, PO Box 30197, Nairobi, Kenya.
- Oudman L, 1994. Work on animal power harness technology in Kenya. pp 422–425 in: Starkey P, Mwenya E and Stares J (eds), *Improving Animal Traction Technology*, Proceedings of the first workshop of the Animal Traction Network for Eastern and Southern Africa (ATNESA), 18–23 Jan 1992, Lusaka, Zambia. Technical Centre for Agricultural and Rural Cooperation, Wageningen, The Netherlands. (ISBN 92-9081-127-7)
- Describes efforts of Draft Animal Power Project, University of Nairobi, to develop alternative harnessing options for local draft animals, including a collar for donkeys, and steel-framed pannier pack saddles.
- Worman F, Thedford T and Bock S, 1990. *Final Report, Donkey Harness Project*. Department of Agricultural Research, Ministry of Agriculture, Gaborone, Botswana.

Implements and carts for donkeys

- Awadhwal N K, 1989. *A report on testing of crust breaker and development and testing of a donkey-drawn cultivator-cum-seeder in Mali*. International Crops Research Institute for the Semi-Arid Tropics, ICRISAT Patancheru P O, Andhra Pradesh 502 324, India.
- Chadborn A, 1991. Some designs for donkey carts and animal-powered engines. pp 251–257 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Emhardt F, 1994. Improving the *Hata* donkey-drawn weeder in Niger: experience and results. pp 210–213 in: Starkey P, Mwenya E and Stares J (eds), *Improving Animal Traction Technology*, Proceedings of the first workshop of the Animal Traction Network for Eastern and Southern Africa (ATNESA), 18–23 Jan 1992, Lusaka, Zambia. Technical Centre for Agricultural and Rural Cooperation, Wageningen, The Netherlands. ISBN 92-9081-127-7
- The *Hata* is a lightweight, inexpensive donkey-drawn hoe for designed for mechanized weeding on sandy soils. Paper describes an improved implement (structural design) and results of field studies in Niger. Use of the *Hata* decreases weeding time by over 50% (compared to hand weeding) and is 76–85% efficient (compared to hand weeding which is 91–96% efficient).
- Emhardt F, 1994. Rouleau traîneau à traction asine pour aligner des résidus de récolte: cas du Niger. pp 187–198 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9
- Inns F, 1996. Matching tillage implements to draught animal potential. *FAO world animal review* **86**: 40–49
- Karim-Sesay J A, 1993. The effects of harness and implement design on the performance of draught animals: the case of the donkey in Botswana. pp 123–125 in: O'Neill, D H and Hendriksen G (eds) *Human and draught power in crop production*. Proceedings of a

workshop held 18–22 January 1993, Harare, Zimbabwe. Silsoe Research Institute, Bedford, UK and FAO, Publications Division, Viale delle Terme de Caracalla, 00100 Rome, Italy.

Kerman C, 1985. Charrues et traction animale. *Inter-tropiques* **9**: 16–18.

Examines the characteristics and use of donkeys, oxen and horses for work, outlining harnessing techniques suitable for each species.

Management

Akin Hassan W and Ibitoye B A, 1990. Camels and donkeys as pack and transport animals in semi-arid northern Nigeria: herd composition, management and utilisation. pp 140-144 in: Lawrence P R, Lawrence K, Djikman J T and Starkey P H (eds) *Research for development of animal traction in West Africa*. Proceedings of the fourth workshop of the West African Animal Traction Network held 9-13 July, 1990, Kano, Nigeria. International Livestock Centre for Africa, Addis Ababa, Ethiopia. 306p. ISBN 92-9053-276-9

The paper gives the results of a questionnaire survey of 201 camel and donkey owners in northern Nigeria. The average herd size was 6 donkeys, 65% of which were put to work. Average of starting work was 2.6 years with a 3 month training period. The use of donkeys for pack transport was found to be profitable and commercially viable.

Canacoo E A, 1991. Management of the donkey: a southern Ghana experience. pp 189–193 in: Fielding D and Pearson R A (eds),. *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

Coppock D L, Ellis J E and Swift D M, 1988. Seasonal patterns of activity, travel and water intake for livestock in south Turkana, Kenya. *Journal of Arid Environments* **14** (3): 319-331.

The nomads of Turkana exploit a harsh and seasonally variable environment using five livestock species in a dynamic management system. Season, species and management influenced animal activity budgets, with increased water intake (cattle, goats, sheep), reduced travel and increased foraging time in the wet season vis-a-vis the dry season. Camels showed the least seasonal change while cattle showed the most and donkeys were intermediate.

Eley J L and French J M, 1993. Estimating the bodyweight of donkeys. *Veterinary Record* **132**: 250.

Eley J L and French J M, 1994. Bodyweight changes in pregnant and lactating donkey mares and their foals. *Veterinary Record* **134**: 627.

Fielding D, 1994. Indigenous knowledge of working equines: the key to their improved welfare and use. pp 331–340 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9

Jones P A, 1991. *Training course manual on the use of donkeys in agriculture in Zimbabwe*. Agricultural Engineering Training Centre, PO Box BW330, Borrowdale, Harare, Zimbabwe. 81p.

Lungwitz A and Adams J W, 1966. Shoeing mules, asses and oxen. pp 207–212 in *Horseshoeing for horse shoers and veterinarians*. Oregon State University Press, Corvallis, Oregon, USA

Sowe J, Gai B, Sumberg J and Gilbert E, 1990. Foaling and mortality of equines in the Gambia: A national survey. pp 315–321 in Starkey P and Faye A (eds) *Animal traction*

for agricultural development. Proceedings of a conference of the West Africa Animal Traction Network held July 7–12, Saly, Senegal. ISBN 92-9081-046-7

Svendsen E D, 1992. The welfare of working donkeys and mules. pp 83–88 in: Proceedings of the Cairo international meeting on working animals, held 13–16 April 1992, Cairo, Egypt. World Association for Transport, Animal Welfare and Studies, Hardwick Court Farm, Hardwick Lane, Chertsey, KT16 0AD, UK. 208p.

Trawford A G, 1996. A review of programmes in the developing nations to improve the management, welfare and health of donkeys. pp. 29–33 in: Hall S J G (ed): *Traction animal health and technology*. Proceedings of seminar held 11 April 1996, Royal Veterinary College, UK. Universities Federation for Animal Welfare, Potters Bar, UK. 84p. ISBN 0 900767 96 0.

Medical

General

Cox J E, 1984. Castration of horse and donkeys with first intention healing. *Veterinary Record* **115** (15): 372–375.

A simple technique for castration of adult equids, which results in first intention healing, was devised. The technique involves a “closed” castration with or without a transfixing ligature on the spermatic sac and suturing the scrotal skin with polyglycolic acid suture material. The postoperative course was characterized by mild edema only and rapid recovery. Results obtained during castration of 311 adult horses and donkeys are described and discussed. The technique is readily applicable in the field.

Dehghani S and Tabatabaei A, 1993. Salivary calculi in a donkey. *Indian Journal of Veterinary Surgery* **14** (2): 94–95.

Enriquez S, Lopez C A, Chavira H and De Aluja A S, 1995. Activities of the ambulatory clinics IDPT-ILPH-UNAM from the period of July 1994 to June 1995.

Veterinaria - Mexico. **26** (4): 401–405.

Describes activities of ambulatory equine clinic in nine states of Mexico. Details pathological conditions most commonly seen in working horses, donkeys and mules presented by villagers to the clinic. Discusses possible causes for veterinary problems of these animals, such as poor nutrition, overwork, bad harnessing, travel on hard roads, lack of government regulation. Describes suffering of equids transported for slaughter.

Fesseha Gebreab, 1994. Some blood parameters of Ethiopian working donkeys. pp 75–82 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9

Forhead A J, Smart D, Smith R F and Dobson H, 1995. Transport-induced stress responses in fed and fasted donkeys. *Research in Veterinary Science* **58**: 144–151.

Fowler J N, 1995. Common conditions of donkeys in temperate climates. pp 89–95 in: Raw M-E and Parkinson T J (eds) *The Veterinary Annual*. Blackwell Science Publications, London, UK

Hifny A, Mansour A A, Ibrahim I A and Taha M, 1988. The relation of synovial bursae to the work of the donkey. *Assiut Veterinary Medical Journal* **20** (39): 9.

Hill, F W G, 1989. Haematological and Clinical chemistry values for donkeys in Zimbabwe. *Veterinary Journal* **20** (3): 114.

Hutchins B, 1984. The donkey in veterinary practice. *Equine Practice* **6** (1): 8–12.

The increased interest in both ass and mule stock in the United States in the last 20 years is documented. Areas in which the donkey differs from the horse are discussed, including metabolism, foot care and

- anatomy. The address for the American Donkey and Mule Society is given for those who wish more information on donkeys or mules.
- Jakubow, K and Gromadzka-Ostrowska J, 1987. Changes in nonspecific immunity factor in some equidae, camelidae and capridae species. *Comparative Biochemistry and Physiology A: Comparative Physiology* **86** (4): 633–638.
- Plasma lysozyme activity fluctuated by season and over time (in a 2 year study). Patterns observed in donkeys differed from those in ponies, goats or camelids.
- Lopez A, Chavira H and Granillo A, 1994. Foot and hoof disorders in the underprivileged equids of Mexico. pp 57–64 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9
- Lopez-Cabanias A and Chavira-Sevilla H, 1994. Activities of the ambulatory clinics IDPT-ILPH-UNAM from the period of July 1993 to June 1994. *Veterinaria Mexico* **25** (4): 345–347.
- Lopez-Cabanias A, Villalba M and de Aluja A S, 1993. Activities of the ambulatory service IDPT-ILPH-UNAM from July 1992 to June 1993. *Veterinaria Mexico* **25** (1): 55–59.
- The International Donkey Protection Trust (IDPT), International League for the Protection of Horses (ILPH) and the School of Veterinary Medicine of the National Autonomous University of Mexico (UNAM) describe operation of their program of veterinary assistance to equids of marginalized peasants of Mexico. Conditions and numbers of animals (horses, donkeys and mules) treated are described. Poor hoof care and skin lesions were the most common problems.
- Lopez-Cabanias A and de Aluja A S, 1991. Horses treated in the ILPH-IDPT-UNAM ambulatory clinic from April 1990 to April 1991. *Veterinaria (Mexico City)* **22** (4): 445–446.
- Describes the joint program of the School of Veterinary Medicine and Zootechny of the National Autonomous University of Mexico, International Donkey Protection Trust, International League for the Protection of Horses and World Association to assist marginal peasants with the care of their donkeys, mules and horses. Services provided were: deworming, castration, necropsy, vaccination, pregnancy diagnosis, teeth floating, and treatment of: abscesses, withers fistula, tendinitis, contracted tendons, hoof cracks, fractures and colic.
- Mair T S, Dyson S J, Fraser J A, Edwards G B, Hillyer M H and Love S, 1996. Hypertrophic osteopathy (Marie's disease) in Equidae: A review of twenty-four cases. *Equine Veterinary Journal* **28** (4): 256–262.
- 23 horses and 1 donkey presented with hypertrophic osteopathy (HO) had bilateral limb swellings (fore and hind) with stiffness, lameness and weight loss. Radiological features included periosteal new bone formation over the diaphyses and metaphyses of affected bones (usually metacarpal and metatarsal bones). Significant primary diseases believed to predispose to HO were identified in 17 cases.
- Ouragh L, Ouassat M and Machmoum M, 1994. Polymorphisme biochimique du système transferrine chez l'âne au Maroc. pp 155–158 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9
- Soliman, I A, 1989. Clinical observations of hoof deformities in donkeys. *Assiut Veterinary Medical Journal* **21**: 163.
- Whitehead G, French J and Ikin P, 1991. Welfare and veterinary care of donkeys. *In Practice*, March, 1991: 63–68.

Yilma J M, Feseha G A, Svendsen E D and Mohammed A, 1991. Health problems of working donkeys in Debre-Zeit and Menagesha Regions of Ethiopia. pp 151–155 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

Hyperlipidemia

Forhead A J, Smart D, Smith R F and Dobson H, 1994. Endocrine and metabolic responses to transportation in periparturient donkeys. *Animal Reproduction Science* **36** (3-4): 315–327.

To define maternal endocrine and metabolic adaptations to the peripartum period, plasma concentrations of progesterone, oestradiol, 13,14-dihydro-15-keto-prostaglandin, F-2alpha (PGFM), triglyceride, cholesterol, glucose, total protein, urea, cortisol and insulin were examined in two donkey mares throughout late gestation, parturition and early lactation. To assess endocrine and metabolic responses to a stressor in animals under gestational or lactational energy demands, plasma cortisol, triglyceride, cholesterol, glucose and insulin concentrations were examined in the same two donkey mares transported for 4h at 3-10 weeks prepartum and 2-9 weeks postpartum.

Mair T S, 1995. Hyperlipaemia and laminitis secondary to an injection abscess in a donkey. *Equine Veterinary Education* **7**: 8–11.

Naylor J M, 1987. Hyperlipemia. pp. 114–116 in: Robinson N E (eds) *Current Therapy in Equine Medicine 2* W. B. Saunders, Philadelphia.

Reid S W J and Mohammed H O, 1996. Survival analysis approach to risk factors associated with hyperlipemia in donkeys. *Journal of the American Veterinary Medical Association* **209** (8): 1449–1452.

Retrospective survival analysis was used to investigate the effect of gender, body condition and age as risk factors for hyperlipemia in a sample of 130 donkeys developing the disease out of a population of 4, 126 animals. Female donkeys and those of obese body condition were more at risk for developing hyperlipemia than males or those in poor to moderate body condition. Older animals were more at risk than younger animals, and risk was greatest when animals were under stress upon first entered the population from the outside. Pregnancy and lactation were not the principal risk factors in this population.

Reid S W J and Cowan S J, 1995. Risk factors associated with hyperlipaemia in the donkey. *Equine Veterinary Education* **7**: 22–24.

Tripathi B N, Varshney J P and Gupta A K, 1996. Fatty liver in an exotic donkey. *Indian Journal of Animal Sciences* **66** (7): 707–708.

Watson T D G, Packard C J, Shepherd J and Fowler J N, 1990. An investigation of the relationships between body condition score and plasma lipid and lipoprotein concentrations in 24 donkeys. *Veterinary Record* **127**: 498–500.

Laminitis

Mostafa M B, 1988. Acute laminitis in a donkey: a case report. *Indian Veterinary Journal* **65**(4): 348–349.

A case of laminitis in a 6 year old male donkey and its successful treatment are recorded.

Parasites

de Aluja A S, Nunez E, Acevedo A, Neyra J and Ochoa P, 1991. Evaluation of different deworming programs for intestinal nematodes in Mexican donkeys. *Veterinaria (Mexico City)* **21**(3): 269–273.

Reports a 2 year study of intestinal parasites in donkeys in a semiarid high plateau region of Mexico treated at different intervals with Ivermectin. Worm species identified and egg counts for different

- treatments are given. Donkeys living in this semiarid area were not heavily parasitized; none the less a strategic deworming program once a year at the end of the rainy season is recommended.
- Boyt W P, Mackenzie P K I, Pilson R D and Leavis H, 1972. The importance of the donkey (*Equus asinus*) as a source of food and a reservoir of trypanosomes for *Glossina mortisans* Westw. *Rhodesia Science News* 1972: 19–20
- Devi R K L, Sharma S D and Kumar A, 1996. Prolapse of rectum in strongylosis in donkeys. *Indian Veterinary Journal* 73 (7): 779.
- Feseha G A, Mohammed A and Yilma J M, 1991. Vermicular endoparasitism in donkeys of Debre-Zeit, Ethiopia: strategic treatment with Ivermectin and Fenbendazole. pp 156–166 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Gabaj M M, Beesley W N and Awan M A Q, 1992. A survey of mites on farm animals in Libya. *Annals of Tropical Medicine and Parasitology* 86 (5): 537–542.
- Mites were identified on 1303 out of 2287 farm animals (cattle, camels, sheep, goats, horses, donkeys, dogs and rabbits) examined at 58 farms throughout Libya. Common mite species and their hosts are listed. Donkeys carried *Sarcoptes*.
- B M, Hunter A G, Pegram R G and Bourne A S, 1987. Tick infestations on livestock in the Yemen Arab Republic and their potential as vectors of livestock diseases. *Tropical Animal Health and Production* 19 (1): 21–31.
- Tick species and prevalence on cattle, camels, sheep, goats and donkeys were determined. With the exception of camel ticks, burdens of all ticks on domestic livestock were low and are therefore probably not significant in disease transmission.
- Ikede B O, Akpokodje J U, Hill D H and Ajidagba P O A, 1977. Clinical, haematological and pathological studies in donkeys experimentally infected with *Trypanosoma brucei*. *Tropical Animal Health and Production* 9 (2): 93–98. ISSN 0049-4747
- The main effects were dullness, weakness, inappetence, conjunctivitis, tachycardia and polydysponea.
- Karanja D N R, Ngatia T A and Wandera J G, 1995. Donkey klossiellosis in Kenya. *Veterinary Parasitology* 59 (1): 1–5.
- Two out of eight donkeys had gametogonic and sporogonic stages of *Klossiella equi* in their kidneys. Site and description of the parasite is given. No inflammatory reaction could be attributed to the presence of these parasites.
- Khallaayoune K, 1991. Benefit of a strategic deworming programme in working donkeys in Morocco. pp 174–180 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Khalifa R, Monib M E and Mandour A M, 1988. A study of parasites infecting equines in Assiut Governorate. *Assiut Veterinary Medical Journal* 20 (40): 68.
- Khan M Q, Hayat B and Hayat C S, 1987. Prevalence of blood parasites in equines in and around Faisalabad, Pakistan. *Pakistan Veterinary Journal* 7 (3): 113–116.
- Blood samples were collected from 366 equids around Faisalabad. Various smears and tests were prepared. Only 2 species of blood parasites (*Trypanosoma evansi* and *Parafilaria multipapillosa*) were recorded. *T. evansi* prevalence was 5.2 and 9.1 in horses and donkeys, respectively, while *P. multipapillosa* prevalence was 23.7, 18.2 and 11.8 in horses, donkeys and mules, respectively.
- Li W X, 1987. The ecogeographical distribution of ticks in Liaonin Province, China. *Acta Entomologica Sinica* 30 (2): 180–185.
- Thirteen species of ticks, their distribution and hosts are described.

Maloufi F, 1995. Equine parafilariosis in Iran. *Veterinary Parasitology* **56** (1-3): 189–197.

Infection rate of equine parafilariosis in horses, donkeys and mules was established in different areas and seasons of Iran. Highest infection rate was observed in animals 4-9 years of age. The enzootic area encompasses the Caspian littoral, steppes and forest steppes at an altitude of up to 1500 m with a temperate-wet climate. Injected ivermectin was 100% effective in treating infection.

Mattioli R C, Zinsstag J and Pfister K, 1994. Frequency of trypanosomiasis and gastrointestinal parasites in draught donkeys in The Gambia in relation to animal husbandry. *Tropical Animal Health and Production* **26** (2): 102–108.

Prevalence of trypanosomiasis, gastrointestinal strongyles and level of strongyle egg outputs were studied in relation to husbandry practices (feeding, hours worked per day, overnight penning) in the draft donkey population in The Gambia. Husbandry practices significantly affected strongyle egg output but not trypanosomiasis prevalence.

Mukhwana E J, 1994. Helminth parasites of donkeys (*Equus asinus*), Burchell's zebras (*Equus burchelli*) and camels (*Camelus dromedarius*) in a selected area of northern Kenya. pp 45–50 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9

Onoviran O and Odeyemi P S, 1991. Trypanosomiasis in donkeys in Nigeria (abstract). pp 113 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

Pandey V S and Eysker M, 1991. Intestinal parasites of equines in Zimbabwe. pp 167–173 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

Pandey V S and Eysker M, 1988. Parasites of the stomach in donkeys of the highveld of Zimbabwe. *Veterinary Quarterly* **10** (4): 246–248.

Fourteen donkeys from a communal area of the Zimbabwean highveld were examined for stomach parasites during July and November of 1986 and January and April of 1987. All 14 animals were infected with one or more parasite species (*Habronema muscae*, *H. majus*, *Draschia megastoma*, *Trichostrongylus axei*, *Gasterophilus intestinalis*, *G. nasalis*). Burdens of the different parasites varied by month and season.

Pandey V S, Khallaayoune K, Ouhelli H and Dakkak A, 1994. Parasites of donkeys in Africa. pp 35–44 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9

Pegram R G, Zivkovic D and Jongejan J, 1989. Ticks *Acari ixodoidea* of the Yemen Arab Republic II. The Rhipicephalus-sanguineus latreille group. *Bulletin of Entomological Research* **79** (2): 259–264.

423 monthly collections of ticks taken from camels, cattle, donkeys, sheep and goats between September 1978 and August 1979 showed 3 species of Rhipicephalus. Host relationships and ecological affinities of the ticks are described. The most common species, *R. camicasi*, occurred at most sites on all host species. Overall, the numbers of *R. sanguineus* group ticks were low throughout the country and no seasonal patterns could be detected.

- Sahibi H, Bakkoury M and Rhalem A, 1994. Equine babesiosis in Morocco: prevalence and equine ticks. pp 65–74 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9
- Schmann H, Schuster R and Ruscher H J, 1988. Grub infection in a donkey. *Angewandte Parasitologie* **29** (4): 241–143.
Larvae of *Hypoderma diana* were found in a donkey grazing a horse pasture in Germany. The region is also grazed by roe deer, the main host of *H. diana*.
- Selim M E, Abd El-Gawad A F, Ragheb M M and Abd El-Malek M H, 1994. Control of different strongyles worms in donkeys under Egyptian environmental conditions. pp 149–154 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9
- Shams-El-Din H E E and El Nasri M, 1990. Mycoplasmas from donkeys and horses in the Sudan. *Revue D'Élevage et de Medecine Veterinarire des Pays Tropicaux* **43** (3): 323–324.
12 mycoplasma isolates were obtained from 300 donkey nasal swabs. 5 additional isolates were obtained from horses. Biological, biochemical and serological reactions were investigated.
- Silva M G Q, Costa H M A and Silva A V M, 1994. *Trichostrongylus axei* (Cobbold, 1879): Occurrence on equines. *Arquivo Brasileiro de Medicina Veterinaria e Zootecnia* **46** (5): 477–484.
Stomachs of 77 equids from 8 states of Brazil were examined. Prevalence of *Trichostrongylus axei* was 76, 94 and 95% for horses, donkeys and mules, respectively, with a mean intensity of 354, 1, 071 and 737.
- Snow W F, Wachter T J and Rawlings P, 1996. Observations on the prevalence of trypanosomosis in small ruminants, equines and cattle, in relation to tsetse challenge, in The Gambia. *Veterinary Parasitology* **66** (1-2): 1–11.
Prevalence of trypanosome infection in Djallonke sheep, West African Dwarf goats, N'Dama cattle, horses and donkeys at different sites in The Gambia showed a positive correlation with assessments of tsetse challenge. Observations of the grazing ranges of livestock showed that cattle foraged widely into tsetse-infested habitat while sheep, goats and donkeys remained closer to villages, indicating that the livestock management system in The Gambia results in small ruminants and equines having lower exposure to tsetse attack than cattle.
- Svendsen E D, 1994. The main types of parasites affecting donkey's health in various parts of the world. pp 23–34 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9
- Teel P D, Bay D E and Anidagba P A, 1988. Ecology, distribution and host relationships of ticks *Acari ixodidae* infesting livestock in Mali. *Bulletin of Entomological Research* **78** (3): 407–424.
A survey for ticks on livestock in Mali showed 17 species of ixodid ticks recovered from cattle, 12 from sheep, 5 from goats, 4 from horse, 4 from camel and 1 from donkeys. Distribution of different tick species is discussed.

Pharmacokinetics

- Cheng Z, McKellar Q A, Nolan A and Lees P, 1996. Pharmacokinetics and pharmacodynamics of phenylbutazone and oxyphenbutazone in the donkey. *Journal of Veterinary Pharmacology and Therapeutics* **19** (2): 149–151.

Cheng Z, McKellar Q A, Nolan A and Lees P, 1996. Preliminary pharmacokinetic and pharmacodynamic studies on flunixin meglumine in donkeys. *Veterinary Research Communications* **20** (5): 469–472.

Horspool L J and McKellar Q A, 1995. Disposition of penicillin G sodium following intravenous and oral administration to Equidae. *British Veterinary Journal* **151** (4): 401–412.

Plasma disposition and pharmacokinetics of penicillin G sodium following intravenous administration was similar in horses, ponies and donkeys. Dosage interval of 6-8 hours would be suitable to treat infections caused by susceptible bacteria. Although penicillin G was absorbed rapidly following nasogastric administration, systemic availability was low, with high concentrations resulting in cecal liquor, unlike with IV administration. The risk of antimicrobial associated colitis would be high and oral administration would be unsuitable for systemic antimicrobial therapy in the equid.

Lavy E, Ziv G, Aroch I and Glickman A, 1995. Pharmacokinetics, intramuscular bio-availability and bio-equivalence of amoxicillin in donkeys. *Journal of Veterinary Medicine Series B* **42** (5) 284–292.

Disposition kinetics of intravenously administered amoxicillin sodium in 4 adult donkeys were very similar to values reported for horses. Because of a rapid rate of drug elimination, limited distribution volume and high clearance values, IV-injected amoxicillin was likely to result in potentially therapeutic tissue concentrations for a short time (2–3 hours) only, and once-daily treatment would be useful only for very susceptible pathogens.

Malan F S, Reinecke R K and Scialdo-Krecke R C, 1982. Anthelmintic efficiency of fenbendazole in donkeys assessed by the modified non-parametric method. *Journal of the South African Veterinary Association* **82**(3):185–188

Matthews N S, Taylor T S, Mealey K L, Ray A C, Welfare R E and Foster E L, 1994. Pharmacokinetics of gentamicin, ketamine and phenylbutazone in donkeys, mules and mammoth asses. pp 83–88 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9

Matthews N S, Taylor T S and Hartsfield S M, 1991. A comparison of injectable anesthetic combinations in donkeys (poster). pp 140 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

Oukessou M, Bouljihad M, Van Gool F and Alvinerie M, 1996. Pharmacokinetics of ketoprofen in the donkey (*Equus asinus*). *Journal of Veterinary Medicine Series A* **43**(7): 423–426.

Pharmacokinetic parameters of ketoprofen after single intravenous injection were determined in 4 donkeys and compared to those obtained in horses.

Oukessou M, Aissa M and Hmidouch A, 1994. Pharmacokinetic study of benzylpenicillin and amoxicillin in the donkey (*Equus asinus*). *Indian Veterinary Journal* **71** (1): 1077–1081.

Benzylpenicillin was administered intravenously and amoxicillin both intravenously and intramuscularly. Pharmacokinetics of the two drugs in donkeys was similar to that reported for horses.

Protozoal diseases

Davis W P, Dunstan R W, Elliott M W and Peters D F, 1995. Besnoitiosis in a miniature donkey. in: Junge R E (ed), Proceedings of a joint conference of the American Association of Zoo Veterinarians, Wildlife Disease Association and American Association of Wildlife Veterinarians; East Lansing, Michigan, USA, August 12–17, 1995. 546 p.

Woldemeskel M and Gebreab F, 1996. Prevalence of sarcocysts in livestock of northwest Ethiopia. *Journal of Veterinary Medicine Series B* **43** (1): 55–58.

Infestation rate in diaphragm, masseter, cardiac and oesophageal muscle of cattle, sheep, goats, donkeys and chickens was 82%, 93%, 81%, 17% and 7%, respectively. No infestation in fetal cardiac muscle was found. Paper discusses possible impact of sarcocystis on animal health in Ethiopia.

Toxicosis

Dutton M F, 1996. Fumosisins, mycotoxins of increasing importance: Their nature and their effects. *Pharmacology and Therapeutics* **70** (2): 137–161.

Literature review of fusarium moniliforme in humans, horses, donkeys and other species; detection, quantification, analysis, systems affected, South Africa and the Ethiopian region.

Jackson T, 1995. Cyanide poisoning in two donkeys. *Veterinary and Human Toxicology* **37** (6): 567–568.

Two donkeys died acutely in a pasture in New York, with no apparent gross or histopathological lesions at necropsy. Stomach contents were positive for cyanide and cyanide poisoning was diagnosed, possibly incident to eating bark of wild cherry trees.

Tumors

Al-Sadi B I, Singh A P and Al-Badrany M S, 1990. A study of animal neoplasms in Iraq. *Indian Journal of Animal Sciences* **60** (12): 1419–1424.

The clinical and pathological features of 23 neoplasms in domestic animals were studied. Among the rare neoplasms diagnosed were squamous cell carcinoma of the rumen in cattle, squamous cell carcinoma of the orbital cavity in sheep and goats, ameloblastoma in sheep, squamous cell carcinoma of the ano-vaginal region in goats and haemangioma of the vulva in a donkey. Gross and microscopic features of the neoplasms are described.

Lall H K, 1994. Prevalence of tumors in livestock in Kandhar (Afghanistan). *Indian Veterinary Journal* **71** (1): 77–79.

Lall H K, 1994. Prevalence of tumours in domestic animals in Jimma (Ethiopia) with a case record of adrenal tumour in a bullock. *Indian Veterinary Journal* **71** (1): 80–82.

Reid S W J and Gettinby G, 1994. Modelling the equine sarcoid. pp. 167–173 in: Thrusfield M V (ed), *Society for Veterinary Epidemiology and Preventive Medicine, Meeting, Belfast, Northern Ireland, April 13–15, 1994* (ISBN 0-948073-14-4)

Reid S W J, Fowler J N and Smith K T, 1991. Detection of papillomaviral DNA in the sarcoid of the donkey (poster). pp 135–137 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

Singh A P, Yasin M I and Eshoue S M, 1990. Incidence and surgical management of neoplasms in ruminants and equines in Iraq. *Indian Journal of Veterinary Surgery* **11** (2): 21–25.

Reports incidence of neoplastic growth in different species of livestock. Highest incidence was in sheep (43%), then cattle (31%), horses and donkeys (20%) and goats (6%). Females were affected 4 times more often than males. Squamous cell carcinoma of the eye was the most common tumor, followed by papilloma, fibroma, osteosarcoma and melanoma.

Viral and bacterial diseases

Baba S S, Fagbami A H, Ojeh C K, Olaleye O D and Omilabu S A, 1995. Wesselsbron virus antibody in domestic animals in Nigeria: Retrospective and prospective studies. *Microbiologica (Pavia)* **18** (2): 151–162.

Sera from 1,492 animals (camels, horses, donkeys, cattle, sheep, goats, pigs, dogs and fowl) in different vegetational zones of Nigeria was assayed for antibodies to Wesselsbron virus and other flavivirus antigens. 32% of tested sera were positive, with the highest prevalence in animals from swamp forest zone and higher among camels, horses, donkeys and sheep than among goats, pigs or fowl. Wesselsbron virus is actively circulating among livestock populations in this environment.

Baba S S, Olaleye O D and Ayanbadejo O A, 1993. Haemagglutination-inhibiting antibodies against African horse sickness virus in domestic animals in Nigeria. *Veterinary Research (Paris)* **24** (6): 483–487.

A sero-epidemiological study of African horse sickness (AHS) in 261 unvaccinated animals (camels, horses, dogs and donkeys) was carried out in Nigeria. 95% of horses, 100% of donkeys, 10% of camels and 35% of dogs tested were positive for antibodies to AHS virus.

Bilzer T, Planz O, Lipkin W I and Stitz L, 1995. Presence of CD4+ and CD8+ T cells and expression of MHC class I and MHC class II antigen in horses with borna disease virus induced. *Brain Pathology* **5** (3): 223–230.

Tissues from 9 horses and 1 donkeys suffering from natural Borna disease were investigated. Viral proteins, lymphocytic inflammatory reactions and increased expression of antigens were found in the brain, trigeminal and olfactory systems. No evidence of infection was found in the autonomic nervous system, lung, heart, liver, kidney or gut. Infection may have occurred via the trigeminal nerve.

Browning G F, Ficorilli N and Studdert M J, 1988. Asinine herpesvirus genomes: Comparison with those of the equine herpesviruses. *Archives of Virology* **101** (3-4): 183–190.

Two previously unknown and distinct herpesviruses were isolated from donkeys. One, with the characteristics of a betaherpesvirus, was isolated from the leukocytes of an apparently healthy donkey, while the second, an alphaherpesvirus, was recovered from the nasal cavity of donkeys given high doses of corticosteroids, and caused rhinitis in two seronegative weanling donkeys when they were intranasally infected. Genome sequence characterisation showed these two isolates to be prototypic of two previously unrecorded herpesviruses, for which the names asinine herpesvirus 2 and 3 are suggested for the betaherpesvirus and alphaherpesvirus, respectively.

Guo Y, Wang M, Zheng G S, Li W K, Kawaoka Y and Webster R G, 1995. Seroepidemiological and molecular evidence for the presence of two H3N8 equine influenza viruses in China in 1993-94. *Journal of General Virology* **76** (8): 2009–2014.

In May, 1993 a severe epidemic of respiratory disease began in Inner Mongolia and affected horses, mules and donkeys throughout China. Antigenic and sequence analysis established that this influenza virus causing the epidemic were of recent equine-2 origin and not a reoccurrence or reassortant of the avian-like influenza viruses detected in horses in China in 1989. This new virus has probably established itself in horses in Asia.

Jan A H and Sham M F, 1989. Natural occurrence of Babesiosis in ungulates of North-west Frontier province, Pakistan. *Scientific Khyber* **2** (2): 293–298.

Blood smears were prepared from horses, donkeys, cattle, sheep, goats and camels during 1979-80. Six species of Babesia were found in the different livestock species. Only one species (*Babesia equi*), with a 30% incidence, was seen in donkey blood.

Lord C C, Woolhouse M E J, Rawlings P and Mellor P S, 1996. Simulation studies of African horse sickness and *Culicoides imicola*. *Journal of Medical Entomology* **33** (3): 328–338.

A simulation model of African horse sickness in Spain was developed to investigate what factors affect the likelihood of an epidemic after the introduction of the virus in horses and donkeys. In general, if an epidemic occurs most hosts were infected. Most significant factors were midge population size, recovery rate in horses and time of year.

McCullum W H, Timoney P J and Tengelsen L A, 1995. Clinical, virological and serological responses of donkeys to intranasal inoculation with the KY-84 strain of equine arteritis virus. *Journal of Comparative Pathology* **112** (2): 207–211.

All of 7 female donkeys became infected after inoculation with KY-84 strain of equine arteritis virus (EAV). The only clinical signs were fever, mild depression and a slight nasal or ocular discharge. Viral replication in the donkey appeared to mirror that previously described for the horse.

Misra V C, Sharma M and Thakur V, 1995. Glanders: An appraisal and its control in India. *Indian Veterinary Medical Journal* **19**(2): 87–98.

Paweska J T, Volkmann D H, Barnard B J H and Chirnside E D, 1995. Sexual and in-contact transmission of asinine strain of equine arteritis virus among donkeys. *Journal of Clinical Microbiology* **33** (12): 3296–3299.

Two in a group of five naturally seropositive donkey jacks were found to shed equine arteritis virus (EAV) in their semen. Clinical disease resulted in jennies following sexual contact with these jacks as well as after direct intramuscular inoculation of sonicated semen. Results indicate EAV and its disease transmission are analogous in donkeys and horses.

Paweska J T, Aitchison H, Chirnside E D and Barnard B J H, 1996. Transmission of the South African asinine strain of equine arteritis virus (EAV) among horses and between donkeys and horses. *Onderstepoort Journal of Veterinary Research* **63** (3): 189–196.

Lateral and sexual transmission of EAV among horses and lateral transmission between donkeys and horses were attempted by experimental infection with the South African asinine strain. All intramuscularly inoculated horses developed very mild clinical signs, were viraemic, shed virus from nasopharynx and seroconverted. Virus was not transmitted in horses by breeding. All inoculated donkeys and 3 in-contact horses showed clinical signs; virus was isolated from donkey buffy-coat preparations but in-contact horses failed to seroconvert and no virus could be isolated from them. The South African strain of EAV appears to be poorly transmissible to horses, supporting the findings of other field studies which indicate a widespread distribution and long-standing presence of the virus among South African donkeys, but a very restricted prevalence of seropositive horses.

Uppal P K, Yadav M P and Manchanda V P, 1990. Observations on strangles and purpura hemorrhagica as a sequelae to equine influenza infection. *Indian Journal of Animal Sciences* **60** (10): 1149–1153.

A severe equine influenza outbreak in northern India resulted in 90% morbidity and 1% mortality of horses, mules and donkeys, with mortality highest among donkeys. Strangles and purpura hemorrhagica were important secondary complications leading to death.

Zimmerman W, Duerrwald R and Ludwig H, 1994. Detection of Borna virus RNA in naturally infected animals by a nested polymerase chain reaction. *Journal of Virological Methods* **46** (2): 133–143.

Borna disease virus in naturally infected horses, sheep and a donkey was detected for the first time by amplification of viral RNA using PCR. Brain tissue was positive by this assay in all animals with neurological symptoms. Test is specific and sensitive and recommended over conventional methods for monitoring of BDV at a molecular level.

Metabolism and Energy expenditure

Djikman J T, 1992. A note on the influence of negative gradients on the energy expenditure of donkeys walking, carrying and pulling loads. *Animal Production* **54**: 153–156.

Djikman J T, 1991. A note on the influence of negative gradients on the energy expenditure of donkeys walking, carrying and pulling loads (poster). pp 221–223 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

El-Nouty F D, Yousef M K, Magdub A B and Johnson H D, 1978. Thyroid hormones and metabolic rate in burros, *Equus asinus*, and llamas, *Lama glama*: Effects of environmental temperature. *Comparative Biochemistry and Physiology* **60A**: 235–237.

- Mueller, P J, Jones M T, Rawson R E, Van Soest P J and Hintz H F, 1994. Effect of increasing workrate on metabolic responses of the donkey (*Equus asinus*). *Journal of Applied Physiology* **77**(3): 1431–1438.
Reports heart rate, glucose, lactate, hematocrit and cortisol response to draft work of medium intensity and one hour duration. Maximal aerobic capacity (VO₂max) of the donkey was found by galloping two donkeys up a 9.85 slope at 8.2 m/s. VO₂max was 22 times pre-exercise oxygen consumption, while maximum heart rate (223 beats/min) was 5 times resting heart rate. Blood glucose concentration was unchanged by maximal exercise. Energy cost of walking and pulling loads is given.
- Shkolnik A, 1988. Physiological adaptations to the environment: the Israeli experience. pp 487–496 in: Yom-Tov Y and Tchernov E (eds) *The zoogeography of Israel* Dr. W. Junk Publishers, Dordrecht, The Netherlands.
- Smith D G, Nahius A and Archibald R F, 1994. A comparison of the energy requirements for work in donkeys, ponies and cattle. pp 17–22 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9
- Yousef M K, 1991. Energy cost of locomotion in the donkey (abstract). pp 220 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Yousef M K and Dill D B, 1969. Energy expenditure in desert walks: man and burro *Equus asinus*. *Journal of Applied Physiology* **27**: 681–683.
- Yousef M K and Dill D B, 1969. Resting energy metabolism and cardiorespiratory activity in the burro *Equus asinus*. *Journal of Applied Physiology* **27**: 229–232.
- Yousef M K, Dill D B and Freeland D V, 1972. Energetic cost of grade walking in man and burro, *Equus asinus*: desert and mountain. *Journal of Applied Physiology* **33**: 337–340.

Donkey Milk and Meat

- Forrest A R R and Carnegie P R, 1994. Identification of gourmet meat using FINS (forensically informative nucleotide sequencing). *Biotechniques* **17** (1): 24, 26.
- Giufreda M G, Cantisani A, Napolitano L, Conti A and Godovac-Zimmermann J, 1992. The amino acid sequence of two isoforms of alpha lactalbumin from donkey *Equus asinus* milk is identical. *Biological Chemistry Hoppe-Seyler* **373** (9): 931–935.
The complete primary structure of donkey alpha lactalbumin A and B was determined by sequencing of the peptides after purification and cleavage. The A and B fractions are identical in sequence and belong to the horse A-type variant.
- Godovac-Zimmerman J, Conti A, Sheil M and Napolitano L, 1990. Covalent structure of the minor monomeric beta lactoglobulin II component from donkey milk. *Biological Chemistry Hoppe-Seyler* **371** (9): 871–880.
The complete primary structure of donkey minor beta lactoglobulin II is presented. Despite the close structural similarity of the donkey and horse major beta lactoglobulin I components, their minor beta lactoglobulin II components show substantial differences in sequence. The primary structure of the donkey minor beta lactoglobulins II gives new light to the evolution of beta lactoglobulins and other lipocalins involved in retinol binding or reproductive functions.
- Godovac-Zimmerman J, Conti A, James L and Napolitano L, 1988. Microanalysis of the amino acid sequence of monomeric beta lactoglobulin I from donkey milk. *Biological Chemistry Hoppe-Seyler* **369** (3): 171–180.

The complete primary structure of donkey beta lactoglobulin I was determined by pulsed-liquid phase microsequencing of tryptic peptides. Donkey beta lactoglobulin I is homologous to the retinol-binding protein, bilin-binding protein and five other proteins belonging to the new superfamily of hydrophobic molecule transporter.

Ibrahim A M A, Morsy M A, Hewedi M M and Smith C J, 1994. Detection of aldrin and dieldrin in Egyptian milk samples using a competitive ELISA. *Food and Agricultural Immunology* **6** (1): 31–38.

Egyptian milk samples from buffalo, cow, goat, sheep and donkey were analyzed for organochloride pesticide residue. Pesticides were detected in 60-70% of the samples with the exception of goat's milk (only 25% of samples).

Yman I M and Sandberg K, 1987. Differentiation of meat from horse, donkey and their hybrids, mule and hinny, by electrophoretic separation of albumin. *Meat Science* **21** (1): 15–24.

Meat from the horses, donkeys, mules and hinnies can be reliably identified by determination of genetic variants of serum albumin by starch gel electrophoresis of meat extracts. Staining of the starch gel for carboxylesterase activity permits differentiation of most horses from donkeys while mules and hinnies cannot be distinguished from horses by their esterase activity alone.

Nutrition

Amaral G Y, Ribeiro J M R and Portugal A V, 1995. Allantoin excretion by the donkey as an indication of caecal microbial protein supply. pp. 215-216 in: Nunes A F et al (eds), *Protein Metabolism and Nutrition*, EAAP Publication No. 81, Instituto Nacional de Investigacion y Tecnologia Agraria y Alimentaria, Madrid, Spain (ISBN 972-8126-01-8)

Choshniak I, 1986. Coping with shortage of adequate food by livestock in the extreme desert. 91–97.

Cuddeford D, Pearson R A, Archibald R F and Muirhead R H, 1995. Digestibility and gastrointestinal transit time of diets containing different proportions of alfalfa and oat straw given to Thoroughbreds, Shetland ponies, Highland ponies and donkeys. *Animal Science* **61**: 407–417.

Faurie F, Toure M and Tisserand J L, 1990. Comparaison de la physiologie digestive chez les anes et les poneys. *16eme Journee d'Etude*, 7 March, 1990: 46–53.

Gaillard-Martinie B, Breton A, Dusser M and Jullian V, 1995. *Priomyces citronii* sp. nov., a strictly anaerobic fungus from the equine caecum: A morphological, metabolic and ultrastructural study. *FEMS Microbiology Letters* **130** (2-3): 321–326.

Priomyces citronii was isolated from the caecum of one pony and three donkeys. It differed morphologically and metabolically from other anaerobic fungal species. Did not grow on starch or maltose and did not produce D-lactate.

Izraely H, Choshniak I, Stevens C E, Demment M W and Shkolnik A, 1989. Factors determining the digestive efficiency of the domesticated donkey (*Equus asinus asinus*). *Quarterly Journal of Experimental Physiology* **74** (1): 1–6.

Donkeys were fed either a low quality roughage (wheat straw: 77% neutral detergent fibre (NDF), 2.8% protein) or a high quality forage (alfalfa hay: 48% NDF, 23% protein). NDF intake was 10% higher in animals fed straw but fibre digestibility and mean retention time did not differ by diet. Cell wall (for straw) and energy digestion in the donkey compared favorably to digestion by goats in a similar study by the same authors, perhaps because the donkey digests soluble feed components more efficiently than does the ruminant. Short retention times suggests donkeys compensate for low quality diet by increasing intake rate. Urea recycling rate in donkeys fed straw was 75% of the entry rate, achieved through decreased renal urea filtration and increased fractional resorption.

Izraely H, Choshniak I, Stevens C E and Shkolnik A, 1989. Energy digestion and nitrogen economy of the domesticated donkey (*Equus asinus asinus*) in relation to food quality. *Journal of Arid Environments* **17** (1): 97–101.

Energy and water metabolism of Middle Eastern donkeys was studied by feeding either a low quality roughage (wheat straw: 77% neutral detergent fibre (NDF), 2.8% protein) or a high quality forage (alfalfa hay: 48% NDF, 23% protein). Gross energy intake of donkeys fed straw was 67% of those fed alfalfa. Donkeys consumed less energy than reported for horses but more than goats. Resting oxygen consumption of donkeys fed wheat straw was only half the value recorded when fed alfalfa hay. Donkeys maintained constant body weight regardless of diet. Water turnover rates were higher than for goats. It is concluded that the donkey is as efficient as the Bedouin goat in digesting low quality roughage but maintains a high level of intake even when fed wheat straw. By lowering its requirement for metabolic energy the donkey is able to balance its energy metabolism under adverse nutritional conditions but only if sufficient forage is available.

- Izraely H, Chosniak I, Stevens C E and Shkolnik A, 1989. The donkey: coping with low quality feed. *Asian Journal of Animal Science* **2**: 289–291.
- Knapka J J, Bargh K M, Brown D G and Cragle R G, 1967. Evaluation of polyethylene, chromic oxide, and cerium-144 as digestibility indicators in burros. *Journal of Nutrition* **92**: 79–85.
- Lechner-Doll M, Becker G and Engelhardt W v, 1993. Vergleichende Aspekte zur Futterpassagezeit bei Equiden (Comparative aspects of digesta passage in equids). 36–38.
- Mueller P J, Rawson R E, Van Soest P J and Hintz H F, 1995. Influence of nutritional status on metabolic response to exercise in donkeys. *Equine Veterinary Journal Supplement* **18**: 400–405.
- The metabolic consequences of submaximal exercise following long term nutritional deprivation was studied in six donkeys fed either timothy hay or wheat straw. Plasma concentrations of glucose, lactate, free fatty acids, cortisol and insulin were determined in animals before and during draft work on a motorized treadmill. In underfed animals, resting heart rate was lower but heart rate during work was higher. Free fatty acids increased and cortisol decreased in nutritionally deprived animals while glucose homeostasis was maintained even on a diet of wheat straw.
- Mueller P J, Rawson R E, Van Soest P J and Hintz H F, 1995. Oxygen uptake during exercise is increased by nutritional deprivation in donkeys. *FASEB Journal* **9** (4): A997.
- Mueller P J, Hintz H F, Pearson R A, Lawrence P R and Van Soest P J, 1994. Voluntary intake of roughage diets by donkeys. pp 137–148 in: Bakkoury M and Prentis R A (eds). *Working Equines*. Proceedings of the second international colloquium held 20–22 April 1994, Rabat, Morocco. Actes Éditions, Institut Agronomique et Vétérinaire Hassan II, BP 6202-Instituts, 10 101 Rabat, Morocco. 412p. ISBN 9981-801-11-9
- Pearson R A and Dijkman J T, 1994. Nutritional implications of work in draught animals. *Proceedings of the Nutrition Society* **53** (1): 169–179.
- Literature review covering cows, donkeys, buffalo used for draft: energy requirement, metabolic rate, weight loss, fodder types.
- Pearson R A and Merritt J B, 1991. Intake, digestion and gastrointestinal transit time in resting donkeys and ponies and exercised donkeys given ad libitum hay and straw diets. *Equine Veterinary Journal* **23**: 339–343.
- Pearson R A, 1991. Effect of exercise on the digestive efficiency in donkeys given ad libitum hay and straw diets. pp 79–85 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
- Rutagwenda T, Lechner-Doll M, Drochner W, Lindhauer M G, Beringer H and Engelhardt W v, 1990. The soluble fraction of a number of Kenyan range plants grazed by indigenous ruminants, camels and donkeys. *Journal of Animal Physiology and Animal Nutrition* **64**: 94–102.

???Suhartanto B, Julliand V, Faurie F and Tisserand J L, 1992. Comparison of digestion in donkeys and ponies.

Tisserand J L, Faurie F and Toure M, 1991. A comparative study of donkey and pony digestive physiology. pp 67–72 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

Physiology

Brown D G and Cross F H, 1969. Hematologic values of burros from birth to maturity: Cellular elements of peripheral blood. *American Journal of Veterinary Research* **30**: 1921–1927.

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Canacoo E A, Ellis-Sackey C J and Quashie B S, 1991. Some physiological values of apparently healthy donkeys in Ghana (poster). pp 98–102 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066

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Zinkl J G, Mae D, Merida P G, Farver T B and Humble J A, 1990. Reference ranges and the influence of age and sex on hematologic and serum biochemical values in donkeys. *American Journal of Veterinary Research* **51**: 408–413.

Respiration

Mair T S and Lane J G, 1990. Tracheal obstructions in two horses and a donkey. *Veterinary Record* **126** (13): 303–304.

The clinical signs associated with intramural tracheal obstructions in 2 horses and a donkey were respiratory distress and coughing, aggravated by exercise and excitement. The obstructions were at the level of the thoracic inlet, consisted of cartilage rings and appeared to be developmental in origin.

Mueller, P J and Entin P L, 1996. Respiratory frequency in donkeys increases in response to environmental heat load, *FASEB Journal* **10** (3) A4.

Shows that donkeys at rest can use panting as a thermoregulatory mechanism to maintain heat balance. Black donkeys breathed at a higher frequency than tan donkeys under hot conditions. Respiratory rate varied from 24 (cool environment) to 72 (hot environment) breathes per minute.

Reproduction

Fielding D, 1988. Reproductive characteristics of the jenny donkey, *Equus asinus*: a review. *Tropical Animal Health and Production* **20**: 160–166.

Gastal M O, Henry M, Beker A R, Gastal E L and Goncalves A, 1996. Sexual behavior of donkey jacks: Influence of ejaculatory frequency and season. *Theriogenology* **46** (4): 593–603.

Courtship of 5 jacks was evaluated weekly for 12 months. The sexual characteristics of courtship behavior were recorded before collection of 2 ejaculates, at 4 hour intervals, into an artificial vagina in the presence of a female in either natural or induced estrus. Behavior evaluated included time to first mount, erection and ejaculation; frequency of penile exposure, flehman response, mounts with or without erection and retreats from female. Individual differences were observed but there were no season effects. Some characteristics showed a monthly effect.

Ginther O J, Scraba S T and Bergfelt D R, 1987. Reproductive seasonality of the jenny. *Theriogenology* **27** (4): 587–592.

Reproductive seasonality was studied in 12 jennies in southern Wisconsin, USA. There were seasonal effects on reproduction, with a lower proportion of donkeys ovulating during December than during other months. However, contrary to the literature, the dramatic proportioning of the year into ovulatory and anovulatory seasons, as occurs in mares, was absent or limited in female donkeys.

Orozco-Hernandez J L, Escobar-Medina F J and de la Colina-Flores F, 1992. Ovarian activity in the mare and the female donkey during days with less light. *Veterinaria (Mexico City)* **23** (1): 47–50.

Ovaries of slaughtered animals, pregnant and non-pregnant, were inspected. Percentages of pregnant and non-pregnant mares and jennies with follicular growths on one or both ovaries are given. It

appeared that 87 and 81% of conception of mares and jennies, respectively, occurred between May and September.

- McClure J J, Kock C and Traub-Dargatz J, 1994. Characterization of a red blood cell antigen in donkeys and mules associated with neonatal isoerythrolysis. *Animal Genetics* **25** (2): 119–120.

A red cell antigen of donkeys and mules was identified using antibodies in serum from a mare which produced a foal affected with neonatal isoerythrolysis. The antigen does not correspond to any recognized horse red cell alloantigen; all donkeys and mules tested have the antigen but all horses tested lacked it, suggesting that all pregnancies producing mules are incompatible with regard to this factor and a potential for neonatal isoerythrolysis exists in all cases of a horse dam and a donkey sire.

- Rong T, Chandley A C, Song J, McBeath S, Tan P P, Bai Q and Speed R M, 1988. A fertile mule and hinny in China. *Cytogenetics and Cell Genetics* **47** (3): 134–139.

In China, where mules are bred extensively for work on the farms, a fertile female mule and a fertile hinny have now been verified by chromosomal investigation. Each had mated with a donkey and produced a filly foal. The foals show unique hybrid karyotypes different from the mule's or hinny's and different from each other's. The studies make it clear that mule and hinny fertility, at least for the female hybrid, is a real possibility.

- Traub-Dargatz J L, McClure J J, Koch C and Schlipf J W, 1995. Neonatal isoerythrolysis in mule foals. *Journal of the American Veterinary Medical Association* **206** (1): 67–70.

Four mule foals received anti-RBC antibody from their dam's colostrum. Two foals developed anemia, 1 developed severe thrombocytopenia and 1 had no clinical nor laboratory abnormalities. All foals had the same donkey sire. Seven mares bred to this donkey sire produced anti-RBC antibody, two of them on the first mating. This donkey sire and 18 of its offspring were found to have an RBC antigen unique to mules and donkeys. Thus, all matings of this donkey to horse mares were incompatible. The reason for the high rate of sensitization of mares bred to this donkey is unknown.

- Zong E and Fan G, 1989. The variety of sterility and gradual progression to fertility in hybrids of the horse and donkey. *Heredity* **62** (3): 393–406.

Variability in the degree of sterility of horse/donkey crosses is discussed from the point of view of oestrus, ovulation, mating, pregnancy, spermatogenesis, endocrine activity, isozymes and karyotypic analysis.

Transport

- Aganga A A, Tsoipito C M and Seabo D, 1994. Donkey power in rural transportation: a Botswana case study. *Appropriate Technology* **21**(3): 32–33

- Anon, 1986. Western Samoa: Donkeys as pack animals for small-scale farmers. *World Animal Review* **57**: 49–50.

- Ellis V, Ellis R and Claxton J, 1990. *Donkey Driving*. J A Allen & Co., London, UK. ISBN 0-85131-327-2

Book contains chapters on donkey use and care, vehicles for donkeys, harnessing, training for driving, multiple hitches, preventing accidents, competing in the showing with donkeys in harness.

- Fielding D, 1987. Donkey power in African rural transport. *FAO World Animal Review* **63**: 23–30. FAO, Rome, Italy.

Reviews the status and potential of the donkey as a rural power source in Africa, and discusses ways through which its use could be developed.

- Njenga P, 1993. *Use of donkeys as a means of transport for rural households in Limuru, Kenya*. Infrastructure and Rural Works Branch, Employment and Development Department, International Labour Office, Geneva, Switzerland. 85p.

Water balance

- Adolph E F and Dill D B, 1938. Observations on water metabolism in the desert. *American Journal of Physiology* **123**: 369–378.
- Rate of water intake and output in donkeys and man in the desert, including during mild exercise, was compared. Daily water requirement of a donkey at rest in the desert was found to be 6 liters. Rate of ingestion of water in man was slow in comparison to the donkey, which drank water at a rate to restore its complete deficit within a few minutes.
- ??Dill D B, Yousef M K, Cox C R and Barton R G, 1980. Hunger vs. thirst in the burro (*Equus asinus*). *Physiol. Behav.*, **24**: 975–978.
- Kasirer-Izraely H, Choshniak I and Shkolnik A, 1994. Dehydration and rehydration in donkeys: The role of the hind gut as a water reservoir. *Journal of Basic and Clinical Physiology and Pharmacology* **5** (1): 89–100.
- Body fluid distribution (total body water, extracellular volume and plasma volume) was measured in 3 donkeys fully hydrated, following dehydration and after rapid rehydration. Water content of the GI tract was assessed in 20 donkeys slaughtered in different hydration states. Results suggest the hind gut of the donkey, similar to the rumen of goats and sheep, plays a role as a water reservoir that helps maintain the osmotic stability of the body.
- Maloiy G M O, 1970. Water economy of the Somali donkey. *American Journal of Physiology* **219**: 1522–1527.
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- Green J S, 1990. *The Livestock Guard Donkey*. US Department of Agriculture, Sheep Experiment Station, Dubois, Idaho, USA.
- Hagmann J and Prasad V L, 1994. *The use of donkeys and their draught performance in smallholder farming in Zimbabwe*. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, Germany and Department of Agricultural Technical and Extension Services, Harare, Zimbabwe.

- N R, De Koning J and Matlon P J, 1990. Effect of rock bunds and tied ridges on soil water content and soil properties in the sudan savannah of Burkino Faso, West Africa. *Tropical Agriculture* **67** (2): 149–153.
Donkey traction was used to create rock bunds and tied ridges to improve soil water content. Relative effect of rock bunds vs. tied ridges on soil water, other soil properties (sand, silt, clay, organic matter, runoff) and sorghum grain yield is discussed.
- Mpande R, 1994. Donkey power for appropriate mechanisation and transport for women in Zambezi Valley, Zimbabwe. pp 150–154 in: Starkey P, Mwenya E and Stares J (eds), *Improving Animal Traction Technology*, Proceedings of the first workshop of the Animal Traction Network for Eastern and Southern Africa (ATNESA), 18–23 Jan 1992, Lusaka, Zambia. Technical Centre for Agricultural and Rural Cooperation, Wageningen, The Netherlands. (ISBN 92-9081-127-7)
Discusses advantages and disadvantages of using donkey as draft animals, as compared to oxen and tractors, in marginal communal areas of Zimbabwe. Describes donkey traction project in the Zambezi Valley targeted towards poor women farmers.
- Prasad V L, Marovanidze K and Nyathi P, 1991. The use of donkeys as draught animals relative to bovines in the communal farming sector of Zimbabwe. pp 231–239 in: Fielding D and Pearson R A (eds), *Donkeys, mules and horses in tropical agricultural development*. Proceedings of colloquium held 3–6 September 1990, Edinburgh, Scotland. Centre for Tropical Veterinary Medicine, University of Edinburgh, UK. 336p. ISBN 0907146066
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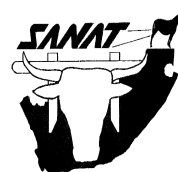
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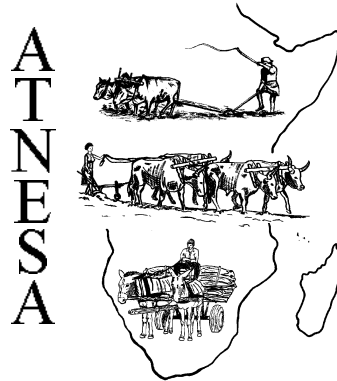
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Animal Traction Network for Eastern and Southern Africa (ATNESA)



Animal traction is an appropriate, affordable and sustainable technology that is increasingly being used in the countries of eastern and southern Africa. Cattle and donkeys are the main draft animals. They provide smallholder farmers with vital power for cultivation and transport.

ATNESA (Animal Traction Network for Eastern and Southern Africa) was formed in 1990 to improve information exchange and regional cooperation relating to animal draft power. The network aims to unite researchers, manufacturers, development workers, institutions and the users of animal traction in the region. Membership of the network is open to all individuals and organisations interested in its objectives. ATNESA is coordinated by a regional steering committee.

ATNESA has arranged several important workshops on improving animal traction, meeting the challenges of animal traction technology, gender issues in animal traction, animal-drawn carts and weeding using animal power. More than 300 people from 35 countries have participated in ATNESA workshops and several resource publications have been produced. ATNESA encourages the formation of national animal traction networks. Contacts for ATNESA and some national networks are given overleaf.