

pheric slope of repose.¹ In these forms one does not see exactly the profiles due to the recent glaciation, for since the disappearance of the Ice Age the head of the cirque has been much modified, the atmospheric slope of repose being induced at the present time. Such in brief appear to be the later steps in the history of the Yosemite Valley.

A NOTE ON THE OCCURRENCE OF PENTASTOMES IN AUSTRALIAN CATTLE.

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WHILST holding a post-mortem at Berry, New South Wales, on some Illawarra cattle suffering from endemic haematuria² one of us found a few tiny parasites in the mesenteric glands. The parasites and the glands from two diseased animals were brought back to the Bureau and carefully worked through. The parasite was, on examination, recognised as a larval pentastome, *Pentastomum denticulatum*, Rud., the adult of which is known as *Linguatula serrata*, Fröl. Since this animal has not been identified as far as we know, from any host in Australia, we desire to draw attention to its presence in New South Wales cattle.³

¹ Johnson's vivid description of these cirques is the best known. The Profile of Maturity.—Journ. Geol., Chicago, xi, 1904, pp. 569–578.

² T. H. Johnston and J. B. Cleland, *Proc. Linn. Soc. N.S.W.*, xxxiv, 1909, p. 510.

³ We have since come across a reference to the finding of pentastome larvæ in Victoria in cattle affected also with pleuro-pneumonia (T. S. Ralph *Austr. Medical Journal*, x, 1865, p. 6). A statement by Barnard and Park (*Rep. Austr. Assoc. Adv. Sci.*, v, 1893, p. 644) seems to infer that they also unknowingly encountered the parasite in Queensland cattle.

The pentastomes or linguatulids form a group of very degenerate Arachnida, and are now regarded as possessing affinities to the vermiform Acarids. The true position of these limbless Arthropods was for long a matter of speculation,¹ until Leuckart traced the life history of the species under review, showing that in one of the early stages, limbs as well as distinctly acarid characters were present.

Excellent accounts of the life history and general anatomy of this worm are given in various textbooks dealing with human and veterinary parasitology.² The main characters of the larva as seen by us were as follows:—The animals were flattened and almost lanceolate, being 5.4 mm. long with a breadth (just behind the anterior end) of about 1.25 mm., tapering fairly rapidly to 0.15 mm. at the posterior end, which was obtusely rounded off. The whole body was finely annulate, 89 rings being counted. The posterior border of each ring possessed a great number of short, strong backwardly-directed spines. Situated anteriorly on the flattened or concave ventral surface were four large strongly curved chitinous claws. These were freely movable and projected prominently when the parasite was viewed laterally. Each claw was provided with a chitinous accessory hook lying just above it. In the mid-line, between the pairs of hooks, the mouth could be recognised as a more or less elliptical aperture leading into the relatively wide intestine. The latter was a simple straight median tube leading to the terminally situated anus.

¹ For a brief summary see Sambon, *Jour. Trop. Med. Hyg.*, XIII, 1910, p. 17-24.

² Cobbold, "Entozoa," 1864, p. 393. Cobbold, "Parasites etc.," 1879, pp. 259-263. Railliet, "Traité de Zoologie agricole et médicale," 1895, pp. 616-623. Neumann, "Parasites," 2nd edit., Eng. transl., 1905, pp. 476-483. Braun, "Animal Parasites of Man," Eng. transl., 1906, p. 378-9. Braun and Lühe, "A Handbook of Practical Parasitology," Eng. transl., 1910, pp. 182-3. Law, "Veterinary Medicine," Vol v, 1903, pp. 215-7. Ostertag, "Handbook of Meat Inspection," 1907, pp. 513-520.

In addition to the living larvae found by us, there were present very many calcified cysts embedded in the glands, the parasites evidently having undergone degeneration, as frequently happens in the case of various larval helminths. Ostertag¹ states that he has never observed the formation of a capsule in the lymphatic glands, whereas all the parasites seen by us were distinctly enveloped in a capsule formed by a modification of the surrounding tissues of the gland. *Pentastomum denticulatum* has been recorded from a number of animals such as cattle, rabbits, hares, sheep, goats, camels, certain deer, rats (*Mus decumanus*) and man,² most of them being herbivorous. The adult (= *Linguatula serrata*) infests the nasal cavities and frontal sinuses of various hosts (mainly carnivorous), such as dog, wolf, fox, horse, goat, etc., and rarely, man. The larvae usually occur in the liver, lungs or lymphatic glands of the infected host.

They may either reach the exterior by way of the trachea or intestines, to be sniffed up by dogs, etc., or they may gain access to their definitive host by the latter eating the infected organs of the intermediate host. It may be remarked that when human beings have been parasitised by the larval form, its presence had not been suspected until post-mortem examinations revealed the fact. In man the liver seems to be the more common location, whilst in cattle the mesenteric glands are said to be the more frequent habitat. Braun,³ Railliet, as well as some of the other writers referred to, give details as to the occurrence of the parasite in its larval and adult stages, in human beings.

The occurrence of the pentastome in our cattle presupposes the existence of its adult stage in our dogs, and also suggests the possibility of human beings becoming infected.

¹ Ostertag, *loc. cit.*, p. 518.

³ Braun, *l.c.*, p. 389.

² For intermediate hosts see Railliet, Braun and others already cited, and also Shipley, *Arch. d. Parasitol.*, 1, 1898, p. 58.

The correct name of this parasite seems to be a matter of difficulty. The larva is usually called *P. denticulatum*, Rud., though *Linguatula serrata*, Fröl. is an earlier name and therefore the more correct one. The adult is also variously named by the writers above referred to, the more common names being *L. taenioides*, Rud., and *L. rhinaria*, Pilger. Of these two names the latter is the older, and therefore the better to use. However, the specific name *serrata* was used for the larva by Frölich in 1789, whilst *rhinaria* was used in 1802 by Pilger, and *denticulatum* in 1805 by Rudolphi. The usual method in helminthology appears to be to retain the earliest name applied to the *adult* as the true specific name even though the *larva* may have been named previously. This has led to the name *L. rhinaria*, Pilger and *L. taenioides*, Rud., being used in preference to the older *L. serrata*, Frölich. Sambon, however, accepts the last named as the true name apparently following the "International Code"¹ which is now binding on helminthology as well as other branches of zoology.

The possible causal relationship of this parasite to the endemic haematuria common in bovines in certain of our coastal districts is a matter now under investigation by us. This disease is characterised by the presence of small angiomatous growths with telangiectases in the bladder of infected animals. From time to time, extensive haemorrhages occur from the vascular tumours leading to haematuria and subsequent anaemia, etc. In the only two animals thus affected examined by us for Pentastomes, these were found. It will be necessary of course to ascertain whether healthy cattle in the same district are also affected and whether the parasites can be found in animals from other parts of New South Wales.² The discovery of these parasites in the cases referred to, suggests that they may play a rôle of much economic importance, but it would be premature to discuss the question further at present with the limited material and facts at our disposal.

¹ Stiles, S. W., "The International Code of Zoolog. Nomenclature as applied to Medicine," *Bull.* 24, *Hyg. Lab. U.S. Pub. Health*, etc., 1905, p. 24.

² Further searching has shown us that it is not uncommon to find pentastomes, generally in small numbers, in the mesenteric glands of cattle from other parts of the State.



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