

ON *ASCARIS VITULORUM* GOEZE.

By C. L. BOULENGER, M.A., D.Sc.

(From the Research Laboratory in Agricultural Zoology,
University of Birmingham.)

(With 3 Text-figures)

UNTIL the appearance of Neumann's paper "Sur l'Ascaride des Bêtes Bovines" (1883), *Ascaris vitulorum* was not generally accepted as a valid species, the form from cattle being referred by different authorities either to *Ascaris lumbricoides* or *A. megalcephala*. Neumann's study of this worm showed, however, that the species differs in many important anatomical characters from the common Ascarids of the pig and the horse and since the publication of his memoir the specific identity of *A. vitulorum* has not been disputed.

My attention was called to this parasite in India last year, the material used for class purposes in the Punjab University including specimens of an *Ascaris* from the Indian domesticated buffalo (*Bos bubalis*). The general macroscopic anatomy of these worms, as seen dissected by students in the laboratory, seemed to agree very well with that described by Neumann, and at the time I had no doubt that I was dealing with the same species as that found in cattle in Europe.

Since my return to Birmingham I have subjected the material to closer microscopic study which showed that the Indian specimens differ in several characters, including some of considerable systematic importance, from the *A. vitulorum* as described by Neumann.

The specific diagnosis of *A. vitulorum*, as now generally accepted, is the following given by Ransom (1911) in his monograph on the Nematodes parasitic in the alimentary tract of Ruminants, and based no doubt largely on Neumann's account:

"Specific diagnosis.—*Ascaris*: Lips without papillae, narrowed anteriorly. Tail terminated by a mucronate, conical tip. Esophagus followed by a rudimentary ventricle.

Male 15 to 25 cm. long by 3 mm. in maximum thickness. Ventral surface of tail supplied with two irregular rows of 10 to 15 papillae each, all preanal.

Female 22 to 30 cm. long by 5 mm. in thickness. Vulva toward the anterior sixth of the body. Eggs 75 to 80 μ in length.

Hosts.—Cattle (*Bos taurus*); zebu (*Bos indicus*)."

The specimens from the Punjab fail to agree in two of the most important of these specific characters, namely the absence of cephalic papillae on the lips and postanal papillae on the male tail, the worms studied by me possessing distinct papillae on the lips in much the same position as in *A. lumbricoides*, the male individuals also bearing genital papillae behind the cloaca.

These, together with other less important points of difference¹, led me to believe that the worms from the Indian buffalo would prove specifically distinct from *A. vitulorum* from *Bos taurus*; I was, however, fortunately able to compare the Punjab material with some Ascarids from ordinary cattle collected by Mr H. E. Hornby in Northern Rhodesia, these proved to agree in all essential respects with the Indian form. I have not been able to obtain any Ascarids from cattle in England, further study will therefore be necessary to settle the questions as to whether the European form is identical with that from Indian and African sources, and whether the discrepancies are due to errors of observation on the part of Neumann or not.

The following account of *A. vitulorum* is based solely on the material from the Punjab and from Northern Rhodesia.

Ascaris vitulorum Goeze, 1782.

Ascaris vituli Gmelin, 1790 (in part).

Length, male, 17.5 to 21 cm.; female, 21 to 27 cm. Thickness, male, 4 to 5 mm.; female, 6 mm. Body colourless in spirit material, tapering at both extremities. Body-wall thin and somewhat translucent.

Cuticle with transverse striations about 0.05 mm. apart.

Head small, 0.7 to 0.95 mm. broad, there are three simple lips, without interlabia. The shape of the lips is as described by Neumann, each consisting of a broad basal region and a much narrower distal region, the latter with a slightly emarginate anterior border.

Dorsal lip 0.45 to 0.6 mm. broad, 0.32 to 0.47 mm. long; bearing two nearly circular, flattened papillae on the basal portion (Text-fig. 1). Ventral lips slightly narrower than the dorsal lip, each bearing a single papilla. The pulp of each lip is divided anteriorly into two lobes. Dentigerous ridges well developed, with strong teeth, 0.06 to 0.075 mm. apart.

Oesophagus considerably shorter than in allied species², 3 to 4.5 mm. in length, divided into two regions, the anterior muscular and club-shaped with a maximum thickness of 0.8 to 0.9 mm., the posterior region in the nature of a 'ventriculus,' 0.45 to 0.6 mm. long and 0.5 to 0.8 mm. broad. The walls of the ventricular region are largely granular in structure.

Male. Posterior extremity slightly curved ventrally. Caudal region with ventral surface distinctly flattened and terminating in a small mucronate

¹ e.g. the more forward position of the vulva in the female.

² In *A. lumbricoides* from the pig the oesophagus has a length of about 9 mm.

appendix. Cuticle of tail somewhat expanded, forming narrow *alae* in the region of the terminal appendix (Text-fig. 2).

Cloaca 0.45 mm. from the posterior extremity of the body.

Preanal papillae in two parallel rows, each consisting of about 13. Behind the cloaca is a pair of larger flattened postanal papillae, the pulps of which

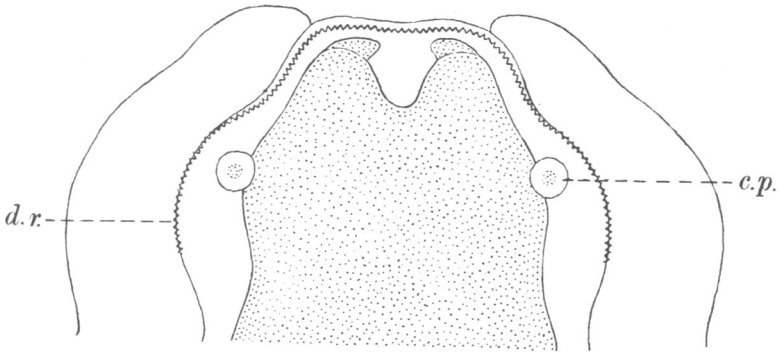


Fig. 1. *Ascaris vitulorum*. Head showing the dorsal lip with papillae. $\times 100$.

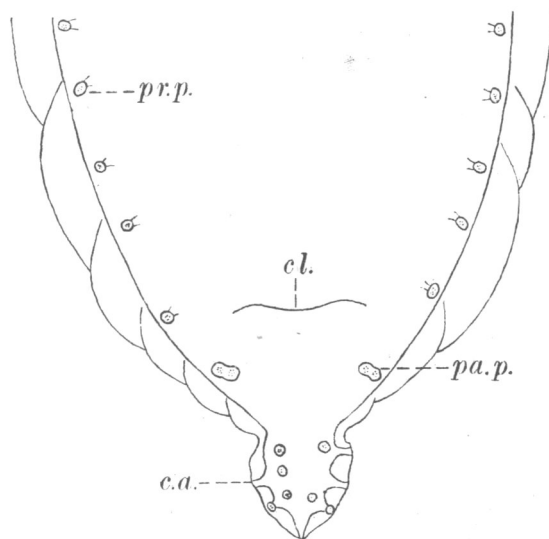


Fig. 2. *Ascaris vitulorum*. Posterior extremity of male, showing caudal appendix and preanal and postanal papillae. $\times 65$. *c.a.* caudal appendix of male; *c.p.* cephalic papilla on dorsal lip; *cl.* cloaca of male; *d.r.* dentigerous ridge of lip; *pa.p.* postanal papilla; *pr.p.* preanal papilla.

have double terminations. The posterior appendix bears about five pairs of small papillae, somewhat irregularly arranged.

Spicules equal, about 0.95 mm. in length. The greatest thickness is about 0.04 mm. anteriorly, each spicule tapering gradually backwards and terminating bluntly.

Female. Tail short, the distance between the anus and the posterior extremity varies considerably in different specimens, from 0.6 to 1.1 mm. (Text-fig. 3).

Vulva situated anteriorly, 25–30 mm. from the cephalic extremity and dividing the total length of the body in the proportion 1 : 8. Internal female organs as described by Neumann; the uteri are fused posteriorly, forming a common tube continuous with the vagina, the latter has a length of about 10 mm., the total length of the unpaired genital duct measuring 30 mm.

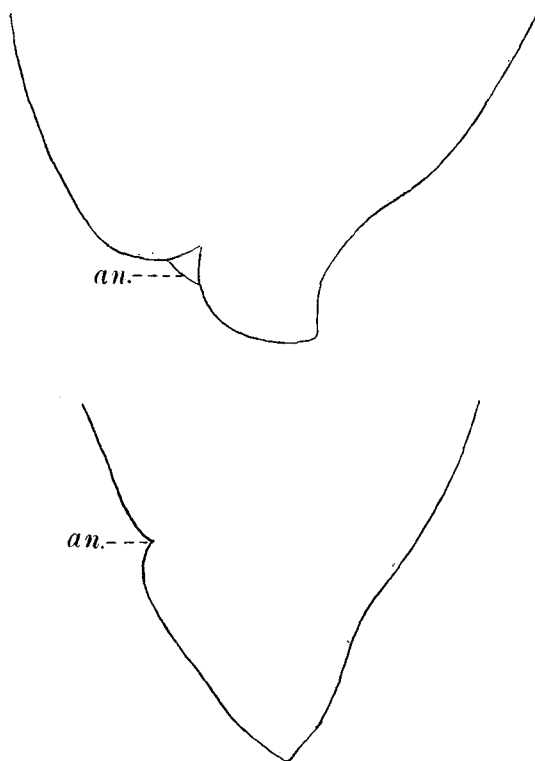


Fig. 3. *Ascaris vitulorum*. Posterior extremity of female, showing variation in length of caudal region, *an.* anus. $\times 35$.

Paired uteri short, about 70 mm. in length, running backwards, parallel with one another; each oviduct bears a conspicuous swelling or ampulla close to its junction with the uterus.

Eggs 0.08–0.095 mm. long \times 0.07–0.075 mm. wide, less coarsely mamillated than those of *A. lumbricoides*.

The character of the oesophagus in *A. vitulorum* is of considerable interest from the systematic point of view; recent authorities, *e.g.* Railliet and Henry (1912) and Baylis (1920), have attached great importance to the structure

of the alimentary canal in the classification of the family Ascaridae, the latter having proposed to unite in the sub-family Anisakinae all genera in which the oesophagus is divided into an anterior muscular portion and a posterior ventriculus of different histological structure.

There can be no doubt that, apart from the structure of the oesophagus, *A. vitulorum* is most closely allied to *A. lumbricoides* and *A. megalocephala* and must be retained in the genus *Ascaris* s. str.

The species described above is evidently a common parasite in both the localities from which my material was obtained; when sending the specimens from Northern Rhodesia Mr Hornby supplied the following interesting note on the occurrence of the worms in that district:

“These parasites are extraordinarily common and, when present in large numbers, cause scouring, wasting and death of the infested calves. Sometimes the small intestine bulges along its whole length owing to the number of worms present. Only sucking calves are affected. Growth after ingestion must be very rapid, as I have found hundreds of worms, from 1 to 7 inches long, in a calf only two weeks' old, and adult worms predominated in a six weeks' old animal.”

I can obtain no definite information as to the time required by *A. vitulorum* to reach maturity after the ova have been ingested, in allied species, however, development is known to be rather slow, the experiments of Epstein (1892) on human subjects and of Ransom and Foster (1920) on pigs have shown that for *A. lumbricoides* a period of about two and a half months is required for full development from the egg in these hosts.

Mr Hornby's observations suggest either that the development of *A. vitulorum* in calves is much more rapid than that of *A. lumbricoides*, or that prenatal infection must take place. The possibility of prenatal infection cannot be excluded in view of the recent development of our knowledge of the migrations of young Ascarid larvae within their hosts.

Neveu-Lemaire (1912) has reported two cases of prenatal infestation in lambs with the lung-worm, *Dictyocaulus filaria*, other indisputable records of such infections with other parasites are to be found in the literature; Cort (1921) has recently published an interesting summary of the known cases.

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