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**SOME PARASITOLOGICAL AND PATHOLOGICAL
STUDIES ON TWO CAMEL PARASITES, DICROCOELIUM
DENDRITICUM (RUDOLPHI, 1819) AND LINGUATULA
SERRATA (FRÖHLICH, 1789)
IN EGYPT
(With 10 Figures)**

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بعض الدراسات الطفيلية و الباثولوجيه على طفيل الديكروسوليم
و اللينجواتيولا فى الجمال بمصر

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أجريت هذه الدراسة على ٦١ جمل ذبحت بمجزر القاهرة ، فحصت الغدد الليمفاوية والأكباد لهذه الجمال بالطرق الطفيلية و الباثولوجية. أثناء الفحص بالعين المجردة تم اكتشاف إصابة كبد واحد فقط بطفيل ديكروسوليم دندريتيك و إصابة الغدد الليمفاوية لثلاثة جمال بطفيل لينجواتيولا سيراتا. ويعتبر وجود طفيل ديكروسوليم دندريتيك بكبد الجمل المذكور أول تسجيل لهذه الإصابة بالجمال فى مصر. وقد صاحب وجود طفيل ديكروسوليم فى القنوات المرارية بالكبد بعض التغيرات الهستوباثولوجية منها زيادة سمك جدار القنوات كما وجد زيادة فى عدد الخلايا الطلائية المبطنة للقنوات المرارية مع وجود تليف بالكبد. كما شوهد طفيل لينجواتيولا سيراتا فى نخاع الغدد الليمفاوية و التى صاحب وجودها زيادة ارتشاح الخلايا الالتهابية (ايزينوفيل ، نيتروفيل) مع زيادة سمك الأنسجة الضامة لجدار الحواجز بالغدد الليمفاوية.

SUMMARY

The present study was carried on 61 slaughtered camels from which livers and mesenteric lymph nodes were examined parasitologically and pathologically. Macroscopical examination revealed infection with *Dicrocoelium dendriticum* in one liver and *Linguatula serrata* in lymph nodes of three camels. The presence

of *D. dendriticum* in camel liver is considered as the first record of this trematode in Egypt. The pathological changes in the liver due to *Dicrocoelium* infection were thickening and dilatation of the bile ducts. Section from the worm was observed inside the lumen of some ducts. Likewise, proliferation of the bile duct epithelium, severe periportal cirrhosis with atrophy of the hepatocytes could be seen. In the lymph nodes, nymphs of *L. serrata* were seen within the medulla accompanied by thickening of the trabeculae.

Key words: *Camel-Parasites-Egypt*

INTRODUCTION

Camels in Egypt (*Camelus dromedarius*) play a big role in our life. They are used for transportation of crops and guarding borders, in addition to their importance as one of sources of animal protein. They are subjected to different parasites that can affect their health.

In a series of our investigations on camel parasites, and during meat inspection, *Dicrocoelium dendriticum* and *Linguatula serrata* have been encountered infecting camels.

The first parasite, *Dicrocoelium dendriticum* is known throughout the world to inhabit liver and bile ducts of sheep, goat, horse, deer, pig as well as man (Jones and Hunt, 1983). It is an ubiquitous parasite of sheep (Bezubik and Borowik, 1970) and cattle (Gonzalez-Lanza *et al.*, 1993 and Wedrychowicz *et al.*, 1995). Literature concerning infection in camels is still scarce.

The second parasite, *Linguatula serrata*, is cosmopolitan in distribution. Its eggs are found in the nasal and respiratory passages of the dog, fox or wolf, while the nymphal stage is located in the mesenteric lymph glands of herbivorous animals as horse, sheep, goat, bovine or rabbit (Soulisby, 1982). No much details about its pathological effect in such location has been clearly fulfilled.

Therefore, the present study was devoted to give a spot light on some parasitological and pathological aspects concomitant with these two parasites infecting camels.

MATERIALS and METHODS

Fresh samples needed for the present study were collected from 61 camels of both sexes and different ages slaughtered at Cairo abattoir. Individual samples of liver and mesenteric lymph nodes were collected in clean plastic bags

for parasitological examination. Likewise, following necropsy, parts of the same samples were preserved in 10% formalin solution for histopathological examination.

For parasitological examination, the livers were macroscopically examined, then, cut into thin slices and then squeezed to allow any flukes, if present, to ooze from the bile ducts.

The selected lymph nodes were sectioned by several longitudinal cuts, then placed in 0.9% warm saline solution. The recovered parasite was identified macroscopically and microscopically according to Yamaguti (1958) and Soulsby (1982), then measured after being illustrated.

Dicrocoelium worms were placed in N/10 potassium hydroxide solution for 5-10 minutes to permit worms for relaxation, then thoroughly washed in water (Desowitz, 1980). To preserve worms, formalin-alcohol fixative was used. The uterus of other fresh worms was teased open and eggs were removed then described and measured. For pathological examination, after necropsy, the specimens were fixed in 10% neutral buffered formalin, then, processed for paraffin embedding technique. Sections of 4-5 microns were prepared and stained with haematoxylin and eosin (Harris, 1898) and Masson's trichrome stain (Clayden, 1971).

RESULTS

1. LIVER EXAMINATION:

A. Morphological pictures:

Macroscopical examination of livers revealed that one out of 61 cases examined was firm in consistency, pale in colour with multiple greyish white foci in the liver tissue, associated with cirrhosis. No other characteristic changes could be noticed. On pressing the liver surface, a huge number of *Dicrocoelium* adult worms appeared emerging from the bile ducts. When freshly recovered, an individual trematode appeared elongated, flat lancet-shaped provided with a pointed end and the body was smooth. The average length from the oral sucker to the posterior extremity was 5-6 mm and the width from the broadest part of the body was 0.68-1.05 mm. The oral sucker was 0.25 mm in diameter while the ventral sucker was 0.30 mm and is placed in the anterior third of the body. The oral sucker was followed by a short muscular pharynx and a short oesophagus. The intestinal cecum was simple, bifurcated anterior to the ventral sucker and terminated at some distance from the posterior extremity. The testes were tandem, nearly symmetrical and each one measured 0.40 X 0.23 mm on average, they were intercaecal. The cirrus pouch was well developed and situated pre-

acetabular. The ovary was situated behind the testes and measured 0.09 X 0.25 mm on average, it occupied the first part of the middle third of the body. All these structures were clearly evident when the worms were freshly examined. They became clearer after being treated with N/10 potassium hydroxide, then preserved in the formalin-alcohol fixative, however, some little differences in the measurements were noticed. Fig. 1a and b shows the detailed structures of the worm after preservation. The parasite became relaxed and its measurements were slightly changed as follows: the whole length became about 9 mm, the width was 0.57 mm, the testes were 0.30 X 0.30 mm, while the ovary became 0.13 X 0.13 mm. The oral and ventral suckers were 0.20 mm and 0.25 mm respectively. The oral sucker was still smaller than the ventral sucker.

The vitellaria were bilateral, distributed in the middle third of the body. The uterus was branched and extended in the second and third part of the body. When a worm was teased-open, the uterus was seen full with eggs in different stages of divisions. The egg was ellipsoidal in shape, deeply yellow to brownish in colour, provided with a distinct operculum and a thick shell; it measured 42.9-46 X 23.1 μ m (Fig. 2).

B. Histopathological pictures:

The morphology of the lesions included dilatation of some bile ducts with superficial erosions of the lining epithelium. The most significant part of the adult *Dicrocoelium* worms was quite prominent by the appearance of the eggs inside the uterus and was seen within the lumen of the infected bile ducts (Fig. 3a and b), or attached to the wall of the ducts (Fig. 4). Other ducts contained dead, partially calcified adult worms which were surrounded by inflammatory cellular reaction mainly fibroblasts, macrophages and lymphocytes. Some bile ducts showed dilatation and hyperplasia of their lining epithelium (Fig. 5) associated with formation of multiple newly formed bile ducts, the lining epithelium of some newly formed bile ducts appeared degenerated and others showed metaplasia to flattened epithelium with thickening of the walls of the duct by fibrous connective tissue (Fig. 6). Periportal fibrosis as well as inflammatory cell infiltration were observed. This periportal fibrosis gave positive reaction with Masson's trichrome stain (Fig. 7). Cystic enlargement of some bile ducts with atrophy of the surrounding hepatic tissue was clearly seen. Likewise, when the mature eggs were penetrating the wall of the bile ducts into the liver parenchyma, they were surrounded by dense collar of Fibrous C.T. (Fig. 8a and b). Moreover, multiple areas showed degeneration and necrosis of the hepatocytes with inflammatory cell aggregation. The whole picture of the liver due to *Dicrocoelium* infestation was of progressive hepatic cirrhosis and cholangiectasis associated with partial biliary obstruction and pericholangitis.

2. LYMPH NODES EXAMINATION:

A. Morphological pictures:

Macroscopical examination revealed that, three out of 61 lymph nodes were firm in consistency reduced in size and difficult to be cut. They showed whitish grey foci that revealed in cross section and after squeezing, the nymphal stages of *Linguatula serrata*. This pentastome was observed within the lymph node tissue. The parasite appeared milky-white in colour, elongated, wide anteriorly and narrow posteriorly (tongue-like). When freshly recovered, the whole length ranged between 4.5 - 5.5 mm, while its anterior broad part was 3 mm wide. The body was flat, slightly convex dorsally and concave ventrally giving it a spoon-like appearance. The cuticle was transversely striated with several rings, about 80 in number, each of which was supplied with hundreds of thorns directed backwards giving the margin a serrated appearance. The mouth opening was O-shaped, subterminal, and was situated at the concavity of the anterior end. At either sides of the mouth, 2 pairs of strong sharp hooks were arranged archwise (Fig. 9).

B. Histopathological picture:

The histopathological examination of the affected lymph nodes revealed variable degrees of fibrosis and thickening of the trabeculae with hyperplasia of lymphoblasts, plasma cells, neutrophils and eosinophils. Meanwhile, most of the vasculature of the infected lymph nodes showed degeneration in the walls and / or proliferation of the endothelial lining the blood vessels with fibrosis of some lymph vessels. Parts of the pentastome nymphs were encountered in the medulla of the three mesenteric lymph nodes associated with thickening of the trabeculae of the lymph node (Fig. 10a and b). The medullary sinuses appeared dilated and filled with fine eosinophilic network of fibrin. Also, parts of the nymphs were found within the lymph vessels.

DISCUSSION

The present study was carried out on 61 slaughtered camels throughout one year. from the tentative parasitological, macroscopical and microscopical examinations, *Dicrocoelium dendriticum* was found infesting only one liver, moreover, *Linguatula serrata* was recovered in 3 lymph nodes. Camels which graze in desert region may pick up accidentally ants harbouring the infection with *Dicrocoelium metacercariae* along the broad routes of migration. In the present study, this trematode was identified as *Dicrocoelium dendriticum* as the morphological features macroscopically and microscopically were quite similar

to those mentioned by Yamaguti (1958) and Soulsby (1982). Moreover, due to its rarity in camels, little has been written on *D. dendriticum* histopathology. The most important lesions that had been shown in the examined infected liver were progressive hepatic cirrhosis, cholangiectasis, partial biliary obstructions and peri-cholangitis. Similar findings had also been observed in other ruminants by Bengtsson *et al.* (1968); Urquhart *et al.* (1988) and Georgi and Georgi (1990). In addition, Bostrom and Slaughter (1968) and Ewing *et al.* (1968) noted damage of the epithelium lining the bile ducts, marked increase in fibroblast cells and macrophages in the periportal areas of the liver of monkeys infected with *Athesmia* (Trematode: Dicrocoeliidae). In this respect, Urquhart *et al.* (1988) reported that these pathological changes in the bile ducts and hepatic tissues can occur only in heavy infestation with the lancet fluke. Cameron (1951) and Sastry (1983) partly attributed these pathological changes in the liver to the presence of the adult worm in the bile ducts which was considered a permanent source of irritation leading to sclerosis and cystic enlargement of the bile ducts, and partly due to the action of the toxin produced by the worms. The toxic product of the parasite may lead to hypertrophy of the biliary epithelium. Cystic enlargement and proliferation of the bile ducts epithelium were evident along with *Dicrocoelium dendriticum* infection. These observations may be associated with the presence of a huge number of the worms in the bile ducts, causing continuous irritation of the wall of the ducts.

The present findings might be considered, as a new report concerning camels in Egypt.

The other parasite, *Linguatula serrata* nymphal stage, encountered in the mesenteric lymph nodes caused massive thickening of the trabeculae and fibrosis of the lymph node associated with few inflammatory cellular reaction. These findings were in agreement with those of Basson *et al.* (1970) and Jones and Hunt (1983) who described the larvae of *Linguatula* in the lymph nodes of domestic animals other than camels, but they did not describe any accompanying host reactions in the affected nodes. *L. serrata* was identified according to Soulsby (1982). In Egypt, El-Refaii and Michael (1988) described the larva of *L. serrata* which was found free under the pleura of the lung of sheep.

From the present study, it was concluded that although there was a low rate of infection among camels with *D. dendriticum* and *L. serrata*, the infected animal may be a source of infection for other animals thus, spreading the parasite on a large scale. Moreover, the parasite when present causes great damage to the liver or lymph nodes, thus, affecting the activity and productivity of camels leading to economic loss. Further studies concerning treatment of *D. dendriticum*

infection in camels must be devoted. For *L. serrata*, control and prophylactic measures as well as stray dogs eradication should be adopted.

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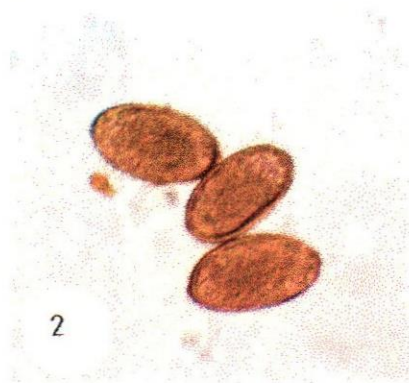
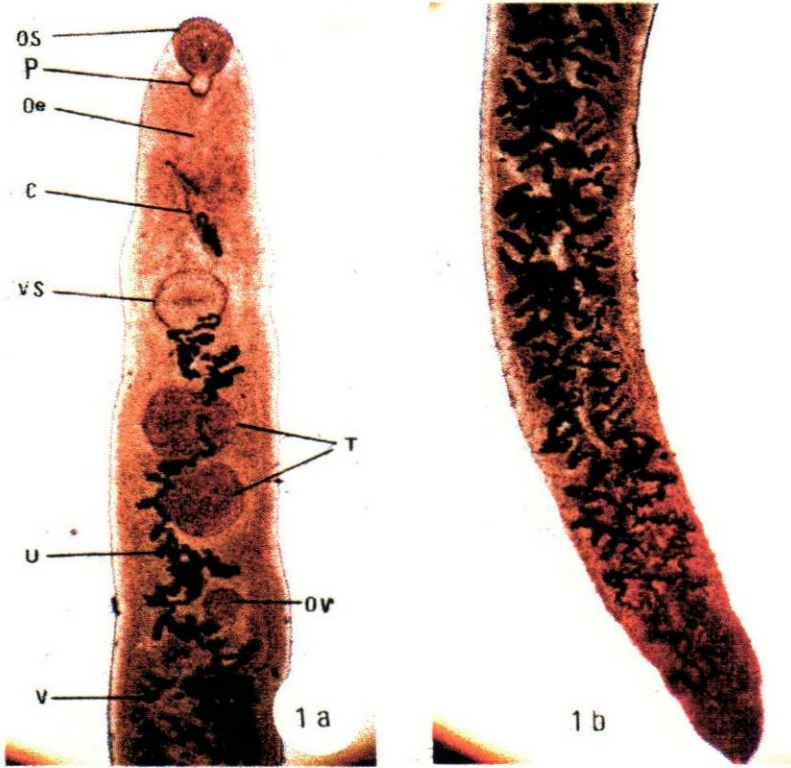
LEGENDS

- Fig. 1:** (a and b). Anterior and posterior parts of *D. dendriticum* worm after preservation. (OS. oral sucker, P. pharynx, Oe. oesophagus, C. cirrus pouch, VS. ventral sucker, U. uterus, T. testes, Ov. ovary, V. vitellaria). X 31.
- Fig. 2:** Fresh *D. dendriticum* eggs. X 500.
- Fig. 3:** (a and b). Camel liver showing section from *D. dendriticum* within the lumen of the infected bile ducts associated with dilatation of the ducts. (W. wall of bile duct, U. uterus of the worm with the eggs inside it). (Haematoxylin and Eosin). (Fig. 3a X 80 and 3b X 125).
- Fig. 4:** Camel liver showing section from *D. dendriticum* attached to the wall of the bile duct with thickening of the wall of the duct. (P. point of attachment, D. Dicrocoelium showing the eggs inside the uterus). (Haematoxylin and Eosin, X 250).
- Fig. 5:** Camel liver showing dilatation of some bile ducts associated with hyperplasia and vacuolation of some lining epithelium and necrotic debris in the lumen. (H. hyperplasia, V. vacuolation, N. necrotic debris) (Haematoxylin and Eosin, X 250).

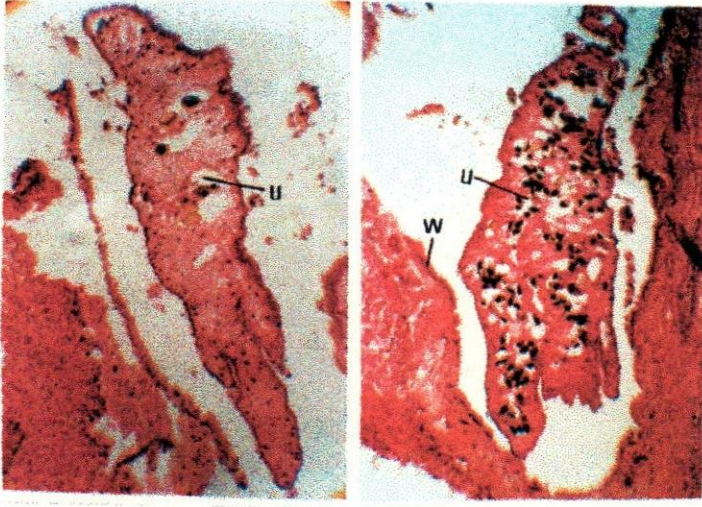
- Fig. 6:** Camel liver showing proliferation of the bile duct epithelium. Some newly formed bile duct showing degeneration of some lining epithelium. The wall of the bile duct was thickened. (Haematoxylin and Eosin, X 100).
- Fig. 7:** Camel liver showing severe periportal cirrhosis with atrophy of the surrounding hepatocytes. (C. cirrhosis, P. pressure atrophy) (Masson's trichrome stain, X 50).
- Fig. 8:** (a and b). Camel liver showing *Dicrocoelium* eggs within the hepatic parenchyma surrounded by fibrosis and pressure atrophy on the hepatocytes. (E. *Dicrocoelium* egg, F. fibrosis, P. pressure atrophy) (Haematoxylin and Eosin, a X 50, b X 125).
- Fig. 9:** Fresh *Linguatula serrata* worm. X 50.
- Fig.10:** (a and b). Mesenteric lymph node of camel showing the Pentastome nymph within the medulla of the node with thickening of the trabeculae. (N. nymph of *L. serrata*, T. thickening of the trabeculae) (Haematoxylin and Eosin, a X 125, b X 500).

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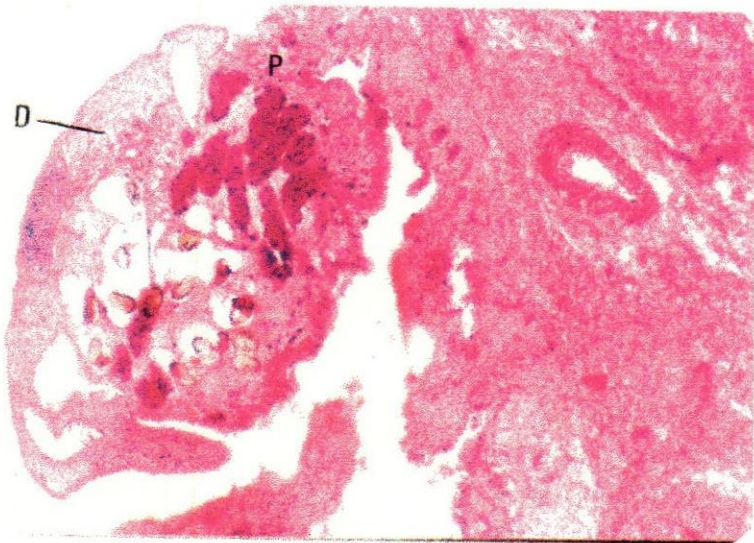






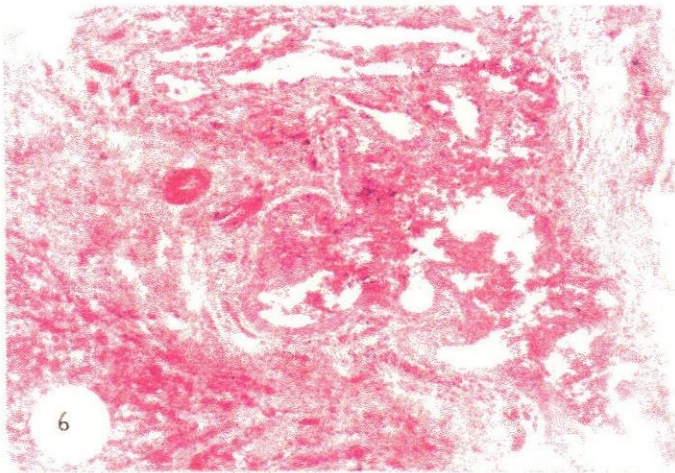
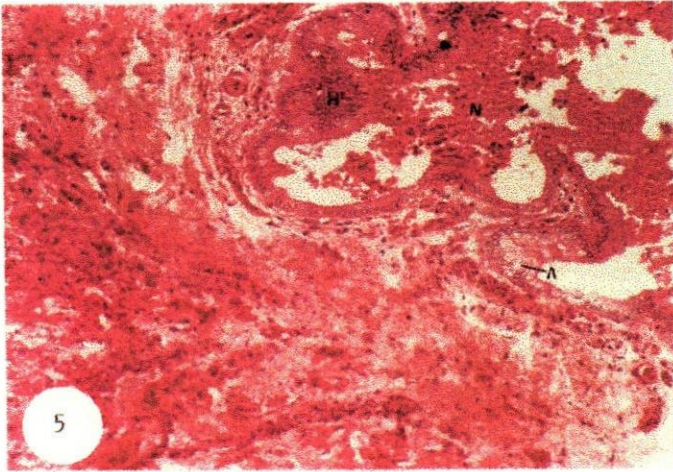
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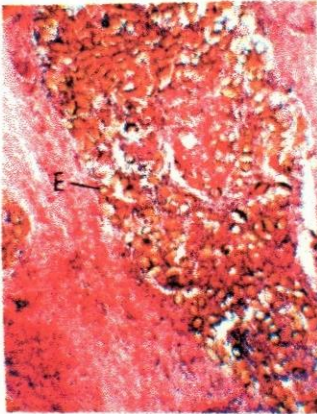
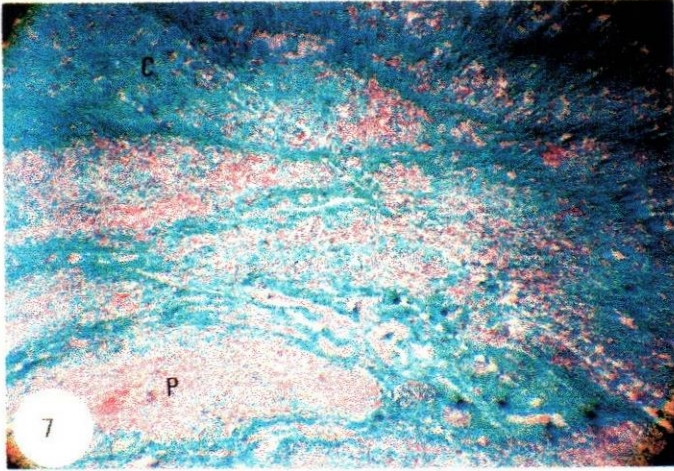


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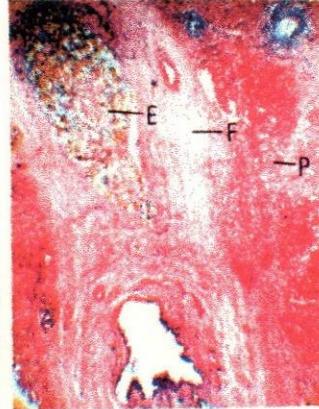






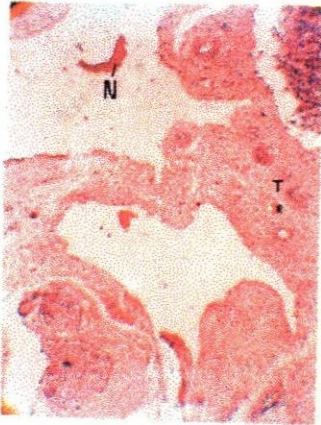
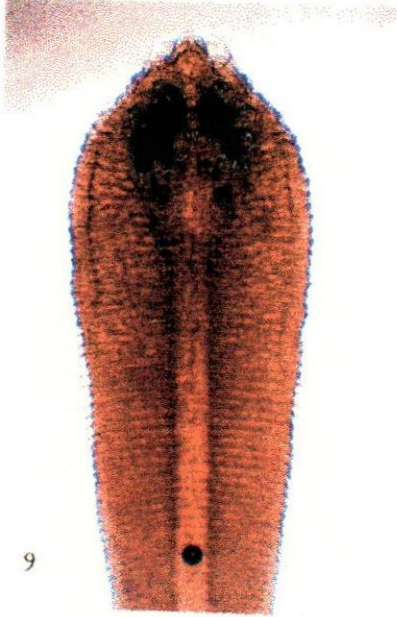


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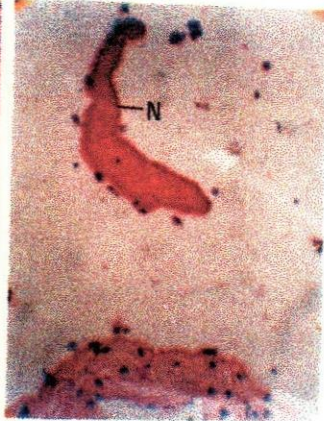


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