

Morphology of *Stilesia vittata* Railliet, 1896 (F: Anoplocephalidae), a Cestode Parasite Isolated from the Intestine of the Dromedary Camel, *Camelus dromedarius* (F: Camelidae)

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Abstract: *Stilesia vittata* is a cestode parasite belongs to the family Anoplocephalidae. The present study aimed to study the cestode parasite isolated from the intestines of the dromedary *Camelus dromedaries* (F: Camelidae) by light microscopy, the location of study was Al-Baha area of Saudi Arabia and the period of study was from March to June 2023. This parasite was identified by its unarmed scolex equipped with suckers found attached to the host intestinal wall. Ten out of 30 (33.33 %) of the examined gastrointestinal tracts were infected. Morphological analysis by light microscopy revealed that scolex was medium in size, well marked off from the strobila, the length x width measured 1.20-1.63 (1.43±0.02) x 1.66-2.33 (2.10±0.02) mm. Suckers were large, oval to round, muscular, measured 0.48-0.72 (0.65±0.02) x 0.47-0.79 (0.65±0.02) mm. Neck long measured 3.69-3.88 (3.71±0.02) x 1.35-1.64 (1.5±0.02) mm. Mature proglottids were nearly seven times broader than long and measured 0.15-0.18 (0.16±0.02) x 1.30-1.35 (1.31±0.02) mm. Testes small, oval to round in shape, located in two lateral fields 6-8 in each group and measured 0.03-0.07 (0.06±0.01) x 0.03-0.05 (0.04±0.02) mm. Vagina and cirrus pouch opened into a common pore known as genital pore, which was small in size, oval to round, marginally regularly alternated. Ootype rounded small in size. From ootype, ovarian lobes were started, ovary was compact, oval in shape and measured 0.034-0.046 (0.042±0.002) x 0.036-0.055 (0.045±0.002) mm. The excretory canals were two pairs in both sides. Gravid proglottids were present in the form of swollen uteri. The morphological characterizations and comparison between the isolated worm and those described previously revealed that it belongs to the family Anoplocephalidae with the type species *Stilesia vittata*.

Key words: Sheep • Anoplocephalidae • Morphology • *Stilesia vittata*

INTRODUCTION

Livestock sub-sector contributes much to the national economy, its development is hampered by different constraints which include rampant animal diseases, poor nutrition, poor husbandry, poor infrastructure, shortage of trained man power, and lack of government policies [1]. Diseases cause extensive financial losses as a result of direct and indirect economic impacts; it is the major concern to small ruminant industry [2]. The production loss to the livestock industry is

estimated to be more than 900 million USD annually [3]. However, most of the surveys paid attention to parasitic causes; fasciolosis and hydatidosis especially in cattle. There is lack information on the causes of organ and carcass condemnations and associated economic losses in small ruminants especially due to a cestode parasite *Stilesia hepatica* that living in the bile ducts of cattle, sheep, goats and occasionally camels. The genus *Stilesia* was erected by Railliet [4] from *Ovis aries* in Europe, Asia and Africa as *Stilesia globipunctata*, later on Railliet [4] described *Stilesia vittata* from *Camelus bacterium* from

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East Africa, later on *Stilesia hepatica* was added from sheep and goat from East Africa in 1903. In India *Stilesia okapi* was described by from *Ovis okapi* at 1936. Kadam. [5] added *Stilesia leiperi* from *Ovis bharal*, later on *Stilesia caballeroi* was erected by Kalyankar [6] from *Capra hircus*. Shinde and Kalse [7] described *Stilesia southwelli*, Later on Jadhav [8] described *Stilesia aurangabadensis* from *Ovis bharal*. Malhotra and Capoor [9] added two new species, *Stilesia gharwalensis* and *Stilesia kothwarensis* from *Capra hircus*, *Ovis bharal*, respectively. *Stilesia marathwadensis* from *Capra hircus* was added at 1985, Deshmukh and Shinde [10] added *Stilesia dhondage* from *Capra hircus*; Patil and Menkudle [11] added *Stilesia capari* from *Capra hircus*, later on Pawar *et al.* [12] added *Stilesia ambajogaensis* from *Bos indicus*. Later on *Stilesia pandeyi* was described by Nanware and Jadhav [13] from *Capra hircus*. Khadap [14] reported *Stilesia indapurensis* from *Capra hircus*, in 2004. The life cycle of this parasite is not well known. The intermediate hosts are reputedly soil mites of the family Oribatidae, which need rich, moist soil, and in which the infective stage, the cysticeroid occurs. They cause neither clinical signs nor significant liver pathology, although massive infections may cause mild cholangitis [14]. The worms are widespread throughout the subcontinent and are usually only encountered at autopsy or at the abattoir. Large numbers of livers are condemned because of the presence of this worm and represents considerable economic loss. Control by disturbing the habitat of the soil mites by ploughing, especially near kraals or places where dung accumulates [13]. In the present study, morphological characterization of *Stilesia vittata* Railliet [4], a cestode parasite isolated from the intestine of the dromedary *Camelus dromedaries* is carried out on the basis of light microscopy.

MATERIALS AND METHODS

The present study was conducted on 30 gastrointestinal tracts collected from the dromedary *Camelus dromedarius* (F: Camelidae) at the main slaughterhouse, Al-Baha area of Saudi Arabia during the period from March to June 2023. After dissection and isolation of the gastrointestinal tracts, they were transported to the Parasitology laboratory. The various organs were separated from each other, placed individually in shallow plastic jars containing normal saline (0.85%) and were examined for helminth parasites followed by standard methods of Boomker *et al.* [15]. The contents of the intestine were put into separate

plastic containers and each was made up to 1000 ml with water. The contents were thoroughly mixed using a glass pipette and the digest were sieved through a sieve with 25 μ m mesh size. The various aliquots of the digestive tract and the entire digests were taken into large Petri dishes and were examined under the microscope for parasitic worms. Worms were washed in normal saline to free them from mucus. Relaxation is the first important step during examination of cestodes, worms were placed in 4% formalin, 2 - 4 hours. After fixation, samples were washed in distilled water for 15 minutes to remove the excess fixative and then processed to staining which is carried out by using acetic acid alum carmine for 5-10 minutes according to Carlton [16]. After staining, a differentiation step must be carried out to remove the excess stain by placing the stained worms to a dilute solution of acid alcohol (0.5 ml in 1000 ml alcohol), it is better to carry out this process under a binocular dissecting microscope to detect the end point of differentiation. This is followed by dehydration in an ascending series of ethyl alcohol, 30%, 50%, 70%, 90%, 95% and absolute alcohol, leaving parasites for 2-5 minutes in each grade. The specimens were then cleared in xylene, then mounted in Canada balsam, covered with cover glass and left to dry in an oven at 40°C. Photomicrographs were taken by the use of Olympus BX53 microscope (Olympus Corporation, Tokyo, Japan). Drawings were made by camera Lucida.

RESULTS

Worms were recovered from the intestine of the examined dromedary hosts *Camelus dromedarius*, where they were morphologically described and identified as *Stilesia vittata* (F: Anoplocephalidae).

Stilesia vittata Railliet [4]: Figures A-F: The recovered worms were long, measured 48-59 (52 \pm 2) cm including scolex, immature, mature and gravid proglottids. The scolex was medium in size, globular, well marked off from the strobila measured 1.20-1.63 (1.43 \pm 0.02) x 1.66-2.33 (2.10 \pm 0.02) mm. Suckers large, oval to round, muscular, lied at four corners measured 0.48-0.72 (0.65 \pm 0.02) x 0.47-0.79 (0.65 \pm 0.02) mm. Neck long measured 3.69-3.88 (3.71 \pm 0.02) x 1.35-1.64 (1.5 \pm 0.02) mm. Mature proglottids were nearly seven times broader than long and measured 0.15-0.18 (0.16 \pm 0.02) x 1.30-1.35 (1.31 \pm 0.02) mm. Testes small, oval to round in shape, located in two lateral fields 6-8 in each group measured 0.03-0.07 (0.06 \pm 0.01) x 0.03-0.05 (0.04 \pm 0.02) mm. The cirrus pouch was medium oval to

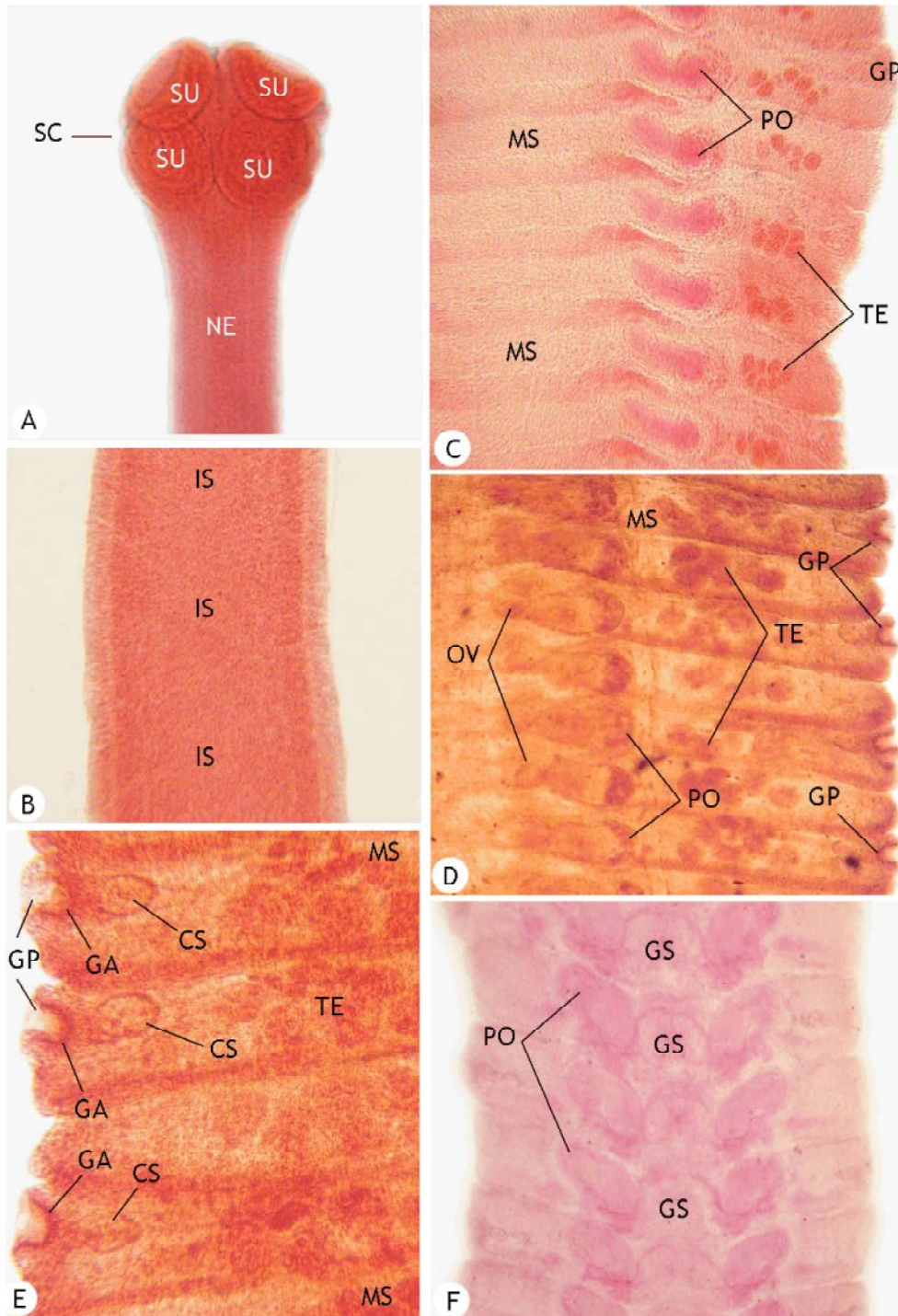


Fig. A-F: Photomicrographs of *Stilesia vittata* infecting the intestine of the dromedary *Camelus dromedaries* showing high magnifications of: (A) The globular scolex (SC) which was marked off from strobila by a long neck (N) and equipped by four large oval suckers (SU), $\times 100$; (B) Immature proglottids (IS), $\times 140$. (C-E) Mature segments (MS) each with small and oval testes (TE) situated in the two lateral fields opened into a common genital pore (GP). The paruterine organs (PO) were large, oval centrally placed, two in each segment containing small, rounded eggs. Ovarian lobes (OV) were compact, oval in shape. High magnifications of the genital atrium (GA), cirrus sac (CS) were shown in figs. 95, (figs. C, D $\times 400$, fig. E $\times 500$). (F) Gravid segments (GS) with WELL developed paruterine organs (PO), $\times 200$.

elongate, marginal and measured 0.11- 0.16 (0.15 ±0.02) x 0.02-0.05 (0.04±0.02) mm. Cirrus thin straight tube runs within the cirrus pouch and measured 0.12-0.18 (0.16±0.02) x 0.003-0.006 (0.004±0.001) mm. Vas deferens short thin tube measured 0.042-0.065 (0.051±0.002) x 0.003-0.005 (0.004±0.001) mm. Vagina and cirrus pouch opened into a common pore known as genital pore, which was small in size, oval to round, marginally regularly alternated. Ootype was rounded small in size. From ootype, ovarian lobes were started, ovary was compact, oval in shape and measured 0.034-0.046 (0.042±0.002) x 0.036-0.055 (0.045±0.002). The excretory canals were arranged as two pairs in both sides measured 0.121-0.135 (0.132±0.002) x 0.024-0.037 (0.035±0.002) mm. The paruterine organs were large, oval centrally placed, two in each segment containing small, rounded eggs, gravid proglottids were present in the form of swollen uteri.

Taxonomic Summary:

Taxonomy: Eumetazoa, Platyhelminthes, Neodermata, Cestoda, Nephroposticophora, Eucestoda, Cyclophyllidea, Anoplocephalidae.

Species: *Stilesia vittata* Railliet, 1896

Host: the dromedary *Camelus dromedaries* (F: Camelidae).

Habitat and infection site: intestine.

Prevalance: 10 (33.33%) out of 30 of the examined gastrointestinal tracts were found to be naturally infected by this parasite. No mixed infection was recorded.

DISCUSSION

The overall prevalence of *S. vittata* isolated from the examined gastrointestinal tracts of the slaughtered camels was found to be 33.33% (10/30). This prevalence was in agreement with the prevalence reported by Ashenafi [17] who recorded a prevalence of 31.04% in the examined sheep and goats slaughtered at helmex abattoir. Sisay *et al.* [18] reported prevalences of 39% and 36% in sheep and goats, respectively and Mungube *et al.* [19] recorded a prevalence of 28% and 22% in sheep and goats, respectively in Kenya. The prevalence reported by Sisay *et al.* [18] is higher than the prevalence recorded in the current study, whereas the prevalence recorded by Mungube *et al.* [19] in Kenya was lower than the current study. This may be related to differences in the agro-ecology of countries. The worm under discussion resembles *S. vittata* Railliet [4] in the presence of testes in

two groups, 5-9 on each side; vas deferens closely coiled, in between cirrus pouch and outer wall of excretory canals, cirrus pouch elongated, cylindrical, cirrus armed. Ovary rounded, vagina posterior to cirrus pouch, uterus transverse as a large tube. Near the anterior margin, paruterine organs two in number, big, develop from the uterus and internal to the excretory vessel. The present tapeworm differs from *S. globipunctata* Railliet [4] in having testes arranged in two groups, 4-7 on each side, vas deferens not closely coiled in between cirrus pouch and outer wall of excretory canal, cirrus pouch small, pyriform. Ventral to vagina, ovary somewhat globular, vagina dorsal to cirrus pouch, uterus globular, immediately dorsal and close to the ovary; paruterine organ develop from uterus. The worm under discussion differs from *S. hepatica*, the mature segments are craspedote, testes in arranged in two groups, 6-7 on each side, preovarian, in anterior half of the segments, vas deferens not closely coiled, but extends up to the longitudinal excretory vessels, ovary small, compact, vagina anterior to the cirrus pouch, uterus transverse as a small tube. In the centre, the paruterine organs situated internal to the longitudinal excretory vessel. Also, it differs from *S. leiperi* Kadam [5], where it have testes arranged in two groups, 5-6 on each side, posterolateral to ovary, vas deferens not closely coiled but extends beyond the longitudinal canals, cirrus pouch is elongated, cylindrical. Ovary is medium in size, almost circular, compact, vagina situated posteriorly to cirrus pouch. Uterus is broad as a transverse tube in the anterior half of the segments with two lateral sacs, having paruterinc organs at distal ends. Paruterine organs develop from the uterus and situated in between dorsal and ventral excretory canals and found in *Ovis bharal*. The present cestode, differs from *S. garhwalensis* Malhotra and Capoor [20] in having testes 1-9 in number on each lateral side, oval to spherical, vas deferens is coiled, extend up to the longitudinal excretory canals. Paruterine organs are small, one on each lateral side of the segment. Found in *Capra hircus* and differ from *S. marathwadensis* Shinde and Kalse [7], in having rounded testes arranged in two groups, 5-7 in number, located posterolateral to ovary, cirrus pouch elongated, cylindrical, present at the anterior margin of the segment. Ovary is medium in size, oval in shape and compact in the anterior half of the segments. Vagina starts from posterior of the cirrus poch. Uterus is thin as a transverse tube near the anterior margin of each segment with two large sacs. Paruterine organs are two in number, oval in shape, large in size containing 12-15 eggs. All of the morphological characterizations reported in the

present study revealed that the parasite resembles with a future recommendation to complete the taxonomic justification by molecular study of the parasite nucleic acid.

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