Global Veterinaria 12 (1): 76-79, 2014
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2014.12.01.76116

Brief Descriptions on the Morphology of Three Species of Nematodes from the Malaysian Domestic Chicken, *Gallus domesticus*, Using Scanning Electron Microscopy

Wahab A. Rahman and Nurul Huda Manaf

Faculty of Agrotechnology and Food Science,
Universiti Malaysia Terengganu Kuala Terengganu, Malaysia 21030

Abstract: A total of three species of nematodes, *Acuariaspiralais, Gonyglonemaingluvicola* and *Heterakisgallinarum*were recovered from the Malaysian domesticchicken, *Gallus domesticus*and studied for their morphology. Scanning electron microscopy was used to study and observe the outer surface of the nematodes. The morphology of the three species of nematodes were briefly described and compared.

Key words: Malaysian Domestic Chicken · Nematodes · Morphology · Scanning ElectronMiscroscopy

INTRODUCTION

Nematodes are invertebrate roundworms and they inhabit marine, freshwater and terrestrial environments. Nematodes belong to phylum Nematoda (or Nemata) which includes parasites of plants and of animals, including that of humans; they also feed on bacteria, fungi, algaeand on other nematodes [1]. Due to its large number of species, nematodes are the most important group of helminthes in poultry. These parasites can cause damage to the host, especially in severe infections.

Nematodes are elongated, cylindrical and un-segmented roundworms. They are covered with a tough, non-cellular layer called the cuticle and they have a well-developed alimentary tract. Most species of nematodes are bisexual andare single worms [2-4].

Most nematode species are of bilateral symmetry [5]. The male nematode has a single testis and the female possesses ovarian tubules [6]. Many species of nematode are oviparous some ovoviviparous while others are viviparous.The adult stage is reached after 4 larval stage molts. Male nematodes are small in size compared to female [6]. Eggs are the transmission stage; some produce the infective larvae that penetrate host body. Nematodes have six stages in their life cycle; egg, four juvenile stages and adult [7].

A typical nematode has a cylindrical or filariform body with the extremities usually more or less attenuated or truncated. The length varies from less than 1 mm to more than 1 m, the ratio of length to breadth varying considerably. They have more elastic and tough cuticle as compared with cestodes and generally smooth, seldom spine, scaled or scattered with bosses and transversely, longitudinally or rarely obliquely striated [8].

There have been many reports of various species of nematodes infecting chickens: *Acuariaspiralis* [9, 10]. *Gongylonemaingluvicola* [11], *Ascaridiagalli* [12, 13], *Oxyspiruraamansoni* [11] and *Heterakisgallinarum* [9, 10].

Scanning electron microscope (SEM) is the one tool that can be used to study of nematodes and also their morphologic and taxonomic studies of nematodes [14].The present paper describes the morphology of these three species of nematodes commonly found in the Malaysian domestic chicken, *Gallus domesticus* using scanning electron microscopy. Morphological differences between the three species were compared.

MATERIALS AND METHODS

Samples: The study was conducted on threespecies of nematodes. The three species were obtained fresh from

Corresponding Author: Wahab A. Rahman, Faculty of Agrotechnology and Food Science,
Universiti Malaysia Terengganu Kuala Terengganu, Malaysia 21030.

the Malaysian domestic chicken, *Gallus domesticus*, obtained from various farms in the northern part of Peninsular Malaysia. The three species of nematodes i.e. *Acuariaspiralis, Gonyglonemaingluvicola* and *Heterakisgallinarum* were identified as according to the descriptions of Soulsby [10].

Scanning Electron Microscope (SEM): The scanning electron microscope (SEM) was used to observe and identify the morphology of the nematode. The nematodes of *Gongylonemaingluvicola*, *Acuariaspiralis* and *Heterakisgallinarum* were fixed in McDowell-Trump reagent at pH 7.2 for 2 to 24 h. The nematodes were washed in buffer in 10 min for 3 times in the same buffer. 1% of osmium tetroxide was post fix at room temperature for 1 to 2 h. The samples were washed two times with distilled water for 10 min and then dehydrated for 15 min in ethanol at concentrations of 50%, 75%, 95% for 2 times and 20 min for 100% for 3 times. After that, 1ml to 2ml ofhexamethyldisilazane (HMDS) was added to the sample tube for 10 min. HMDS was decanted from the tube and the cells were air-dried at room temperature. Then the dried specimens were mounted on the SEM specimen stub with double-sided stick tape or silver paint. The sample specimen was coated with gold or palladium and viewed under the SEM.

Male nematodes *Gongylonemaingluvicola*, *Acuariaspiralis* and *Heterakisgallinarum*were observed at their anterior and posterior parts and also the body surfaces.

RESULTS

Scanning electron microscope was used to study the morphology of nematodes because using SEM, the morphology of this species was easier to differentiate and easy to identify. The male nematodes *Gongylonemaingluvicola*, *Acuariaspiralis* and *Heterakisgallinarum* were observed at their anterior and posterior parts and also thebody surfaces. Plate 1 Ashows the anterior part of *Gongylonemaingluvicola* with the characteristic presence of longitudinal rows of circular plates or bosses at the anterior end. In the posterior part of male *Gongylonemaingluvicola* may be seen papillae (Plate 1B). In *Acuaria spiralis* the cuticle is ornamented with wavy cordon that curve anteriorly and do not fuse (Plate 2A) with the vulva at the posterior end of the female Plate 2B Heterakis gallinarum shows the

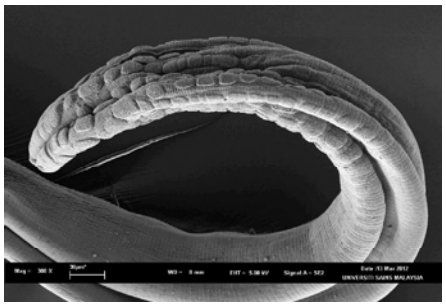

Plate 1A: Anterior end of *Gongylonemaingluvicola* showing the presence of longitudinal rows of round or oval bosses or cuticular plates

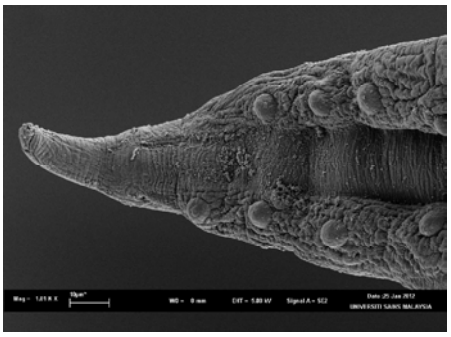

Plate 1B: Posterior end of male Gongylonemaingluvicola showing papillae

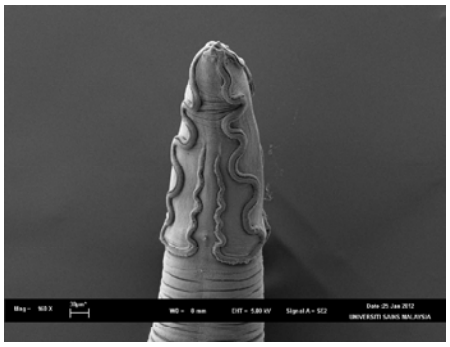

Plate 2A: The anterior part of *Acuariaspiralis*showing the wavy cordons

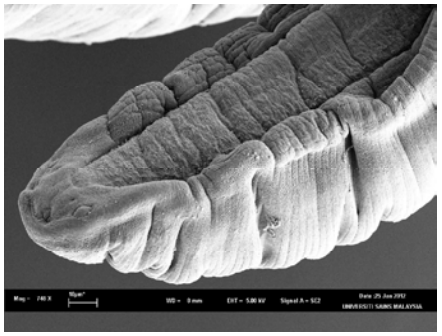

Plate 2B: The posterior part *of Acuariaspiralis* female showing the vulva

Plate 3A: Posterior of male *Heterakisgallinarum* showing the pre-cloacal sucker and spicules of unequal length

Plate 3B: Apical view of the mouth opening showing the lips at the anterior part of *Heterakisgallinarum*

presence of a pre-cloacal sucker and spicules of unequal lengths (Plate 3A) and presence of lips and esophagus at the anterior end (Plate 3B).

DISCUSSION

Nematode bodies are generally elongate and cylindrical, tapering at both ends. A certain degree of sexual dimorphism exists, for the posterior end of males is commonly armed with special structures, for example alae and papillae and is curved ventrally. Almost the male of nematodes species is smaller than females. The various nematode species differ greatly in size. Some of nematode species are microscopic and other species measure no more than 1 mm [2, 3, 12].

The cuticle of parasitic nematodes is generally smooth and the various structures such as spines, bristles, warts, punctuations, papillae, striations and ridges may be present [2,3, 12]. The arrangements and positions of such structures are of taxonomic importance. Under the layer of cuticle that covers the nematode body is a thin layer of hypodermis.

In the present research, the anterior end of *Acuariaspiralis* has four cuticular cordons beginning at sites of lips and running to posterior end, not uniting and not forming marked curves. The cordon was end before reaching posterior end of body [15]. Both sexes also have this cordon; this species is easily separated from others. The caudal end of male has lateral alae and the posterior end body of female are blunt. The vulva of this species lie in posterior third of body [15].

Gongylonemaingluvicola is found in the upper digestive tracts of bird and mammals. The cuticle of the anterior end is covered with large bosses (cuticular plates), or irregular secutes and arranged in eight longitudinal row [9].*Gongylonemaingluvicola* has false lips and mouth capsule is present. Female of this species is longer than male. Male left spicule is slander and havealae. Female vulva opens posterior and furthermore, lips of this species are small and also have a short pharynx with simple wall [10].

*Heterakisgallinarum*has three well-defined lips, the esophagus with a short narrow anterior portion (pharynx) and a long posterior part ending in a bulb [10]. The cuticle is usually with lateral flanges. Esophagus has a short narrow anterior portion (phyranx) and with a long broader posterior portion ending in a well-developed bulb containing a valvular apparatus. The worm is small and white in color. Mouth surrounded by three lips, a small buccal or pharynx. Esophagus ends in a well-developed bulb containing a valvular apparatus.The tail of male has large caudal alae extending some distance down the sides of the body, bearing a number of caudal papillae and a prominent pre-cloacal sucker. The spicules are well developed, unequal, protruding out at anal opening. The tail of female also elongate, narrow and pointed. The vulva of the *Heterakisgallinarum* is situated at the middle of the body.

REFERENCES

1. Platt, H.M., 1994. Foreword: The Phylogenetic Systematics of Free-living Nematodes.S. Lorenzen, Ed. pp.i-ii, The Ray Society, London. pp: 383
2. Foreyt, W.F., 2001. Veterinary Parasitology. Reference Manual (5th Edition). Blackwell Publishing Professional, pp: 3-10.
3. Nnadi, P.A. and S.O. George, 2010. A cross-sectional survey on parasites of chickens in selected villages in the sub-humid zones of south-eastern Nigeria. Journal of Parasitology Research, 20: 1-6.

4. Butcher, G.D., J.A. Hogsette and R.D Jacobs, 1997. Nematode Parasites ofPoultry (and where to find them).Animal Science Department, Florida CooperativeExtensionService, Institute of Food and Agricultural Sciences, University ofFlorida. PS18. FL 32611.
5. Croll, N.A., 1976. The Organization of Nematodes. Academic Press Inc. Ltd, London. pp: 123-182.
6. Lee, D.L., 1965.The Physiology of Nematodes. Oliver & Boyd Ltd. London. pp: 1-64.
7. Croll, N.A. and B.E. Matthews, 1977. Biology of Nematodes. Blackie & Son Ltd, London. pp: 1-152.
8. Yamaguti, S., 1963. SystemaHelminthumVol III. Nematodes.InterscicencePublishers, London. pp: 84.
9. Gerald, D.S. and S.R. Larry, 1996. Foundations of Parasitology. Fifth Edition.W. C. Brown Publishers, Dubuque, Iowa. pp: 355-465.
10. Soulsby, E.J.L., 1968. Helminths, Arthropods, & Protozoa of Domesticated Animals.Sixth Edition. Wilkins Company, Baltimore. pp: 142-351.
11. Noble, E.R. and G.A. Noble, 1974.The Biology of Animal Parasites.Third Edition.Henry Kimptom Publishers, London. pp: 267-336.
12. Cheng, T.C., 1964. The Biology of Animal Parasites. W. B. Saunders Company, Philadelphia and London. pp: 390-472.
13. Monnig, H.O., 1934. Veterinary Helminthology and Entomology. Bailliere, Tindalland Cox, London. pp: 120-255.
14. Eisenback, J.D., 1986. A Comparison of Techniques Useful for Preparing Nematodes for Scanning Electron Microscopy Journal of Nematology, 18(4): 479-487.
15. Skrjabin, K.I., 1969. Key to parasitic nematodes, Vol 1. Spirurata and Filariata. Academy of Sciences USSR, Moscow. pp: 468.