

**MESOCESTOIDES JONESI, N. SP., FROM THE GRAY
FOX, WITH DESCRIPTIONS OF THE CHROMOSOME
COMPLEMENT AND A DICEPHALIC SPECIMEN**

H. CIORDIA

*Department of Zoology and Entomology
University of Tennessee, Knoxville*

INTRODUCTION

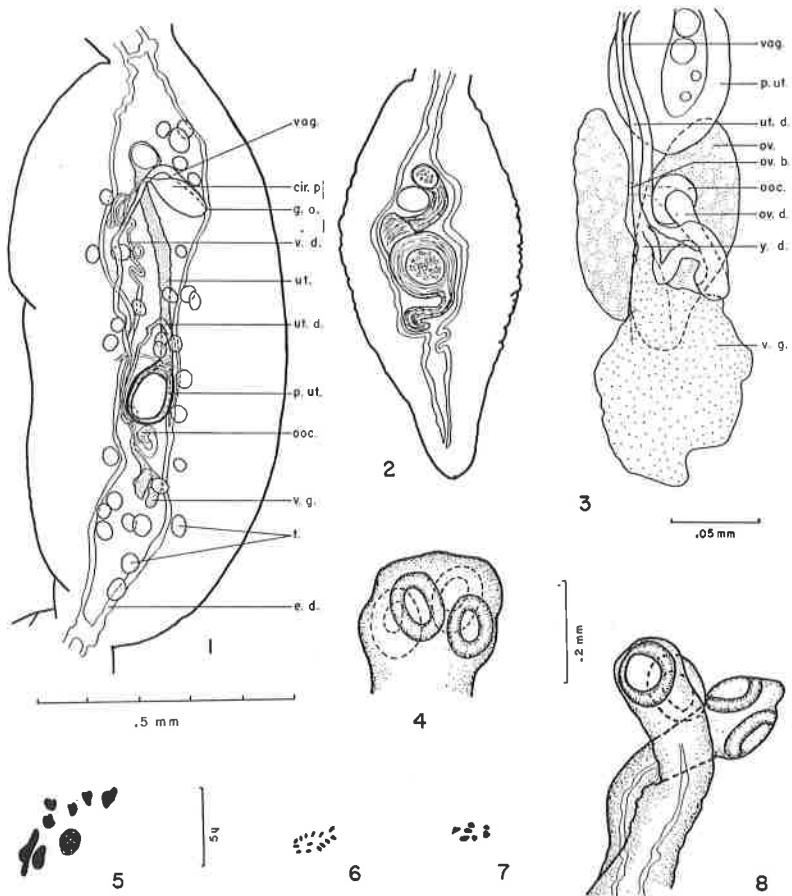
A large number of cestodes were obtained from a gray fox, *Urocyon cinereoargenteus* (Schreber), collected by Dr. J. C. Howell in 1954 in Knox County, Tennessee. After consideration of whole mounts and cross and sagittal sections, the author believes that these worms belong to a new species of the genus *Mesocestoides*.

In view of the present differences of opinion with respect to speciation in the genus *Mesocestoides*, some workers having claimed that "it is possible that the alleged species of *Mesocestoides* from mammalian hosts are in reality morphae of one highly variable species" (Wardle and McLeod, 1952), a cytological study was attempted. This was done in order to obtain some knowledge which might later be of help in determining the validity of the species of that genus already described by comparing the number and perhaps the morphology of their chromosomes. Of course, the other species must also be studied cytologically before conclusions can be reached.

The following description is based on approximately 110 specimens which were recovered from the small intestine of the gray fox. All the worms were removed alive, transferred to physiological saline solution and fixed in Carnoy's fluid (6:3:1). Totomounts were stained in Semichon's carmine. Serial sections were cut at 8, 10, and 12 microns and stained in iron hematoxylin. Drawings were made with the aid of a camera lucida.

Mesocestoides jonesi n. sp.

Description: With characters of the genus. Length 5.5 to 12.0 mm., with maximum width, in last proglottis, of 0.38 to 0.47 mm.; total number of segments 9 to 25. First few segments wider than long when worms are relaxed. Last segment 0.81 to 1.73 mm. long, varying greatly in shape from lanceolate to cucurbitiform, and usually smaller than the preceding two or three segments. Scolex 0.19 to 0.27 mm. in diameter and 0.19 to 0.33 mm. in length, standing out conspicuously from the neck only when the worm is in an extended condition (Fig. 4). Suckers in pairs, ventral and dorsal, measuring from 0.13 to 0.22 mm. long and 0.09 to 0.12 mm. wide. Neck 0.50 to 1.14 mm. long and from 0.1 to 0.3 mm. wide. Primordia of the genital organs first observed as a cylindrical mass of dark staining cells about 0.21 to 1.04 mm. from the junction of the scolex and the neck, usually just before segmentation begins. Calcareous corpuscles abundant.



EXPLANATION OF PLATE

Scale of magnification for figures 2, 4, and 8 is the same. Other scales as indicated.

Fig. 1. Mature segment.

Fig. 2. Last segment.

Fig. 3. Female reproductive organs in a sexually-active young proglottis.

Fig. 4. Normal scolex.

Fig. 5. Chromosomes in first cleavage division.

Fig. 6. Mitotic chromosomes of a macromere of an embryo.

Fig. 7. Metaphase I in testis.

Fig. 8. Scoleces of the dicephalic specimen.

The internal anatomy of the proglottides is typical of the members of the genus *Mesocestoides*. Two large longitudinal excretory ducts run the length of the worms. They give off smaller branches around the area of the parauterine organ, which connect back to the main ducts shortly. The two longitudinal canals fuse in the interproglottidal zones (Fig. 1).

The testes (Fig. 1, t.) number between 24 and 32, all except 9 to 11 being located between the longitudinal excretory canals. They are arranged in irregular rows and encircling the longitudinal canals. This arrangement is evident from the first appearance of the testes in very young proglottides. The testes are irregularly spherical or ovoid in shape, measuring from 0.025 by 0.038 to 0.048 by 0.035 mm. in mature proglottides. Testes are still present even when the ovaries have entirely disappeared. A large duct, the vas deferens (Fig. 1, v.d.), is formed by the fusion of the two vasa efferentia just anterior to the parauterine organ. The vas deferens follows a tortuous path until it becomes attached to the cirrus pouch (cir. p.) at the aporal end. The cirrus pouch is an ovoid structure measuring from 0.030 to 0.075 mm. in diameter and from 0.066 to 0.135 mm. in length. Its posterior end is located in the middle of the proglottis and its anterior end is directed antero-dorsal to reach the genital pore. The cirrus pouch first becomes conspicuous in proglottis 2 or 3. The genital pore is located along the midline of the dorsal surface of the proglottis. Leading from the pore an atrium can be seen adjacent to the pouch. This atrium receives the vagina (Fig. 1, vag.) along the antero-ventral side and the male duct from the cirrus pouch. The genital pore is present early during the development of the cirrus pouch.

The female reproductive system consists of a pair of irregularly oval ovaries, (Fig. 3, ov.) which are connected together by the ovarian bridge. The separation between the ovaries varies considerably from a complete separation to almost fusion. The ovaries are located ventrally, just posterior to the parauterine organ. The ovaries measure from 67 by 29 microns to 173 by 94 microns in a sexually mature segment, but are reduced in size in older segments until they eventually disappear, one of them usually persisting longer than the other. It was found that the ovaries are characterized by their reduced affinity to stains, this making it somewhat difficult to study them from whole mounts. The ovaries are made up of large loose cells, surrounded by a very thin membrane, hence their irregular surface. The oocapt (Figs. 1 and 3, ooc.) appears as a circular structure (ca. 0.025 by 0.314 mm.) connecting the ovarian bridge with the oviduct (Fig. 3, ov.d.). From the oocapt the oviduct extends posteriorly and then turns antero-ventrally forming a sharp loop. At the end of this loop the oviduct bifurcates, giving rise to the vagina and another larger duct which connects with the yolk

duct to form the uterine duct (ut. d.). The vagina is a relatively thick-walled tube following a more or less straight path anteriorly, to become enlarged while arching over the cirrus pouch before entering the atrium. The shell gland surrounds the uterine duct right after the fusion of the oviduct with the yolk duct. The uterus appears as a mass of dark staining cells between the excretory ducts in the posterior part of the neck region. The testes are noticeable in that same region as very small groups of dark staining cells, close together and arranged in two rows. The uterine mass continues to increase in size and becomes elongated. In about the third proglottis the uterus becomes constricted, assuming a dumbbell shape. The cirrus pouch develops from the anterior sac of the uterus and becomes separated from it in the next proglottis. At this time the yolk gland and the ovaries are very conspicuous. As eggs are produced, the anterior bulb of the uterus, as well as the posterior one, enlarges. A large group of dark staining cells, the parauterine cells, surround the posterior bulb and give rise to the parauterine organ, which is evident in the subsequent proglottis. As the parauterine organ increases in size, the uterine bulbs decrease in size because of the migration of the eggs into the egg capsule in the parauterine organ. In gravid proglottides the parauterine organ is circular in shape and very conspicuous and develops an S-shaped caudal appendage (Fig. 2). The egg capsule is from 0.165 to 0.216 mm. long and from 0.105 to 0.183 mm. broad. The egg mass varies from 0.080 to 0.144 mm. broad and from 0.080 to 0.144 mm. long. Eggs are ovoid, measuring from 0.021 to 0.030 mm. by 0.018 to 0.021 mm. The vitelline duct (Fig. 3, v. d.) projects from the dorsal surface of the bilobed vitelline gland (Fig. 3, v. g.), exhibiting a constriction before its anastomosis with the oviduct. In young sexually mature proglottides the lobes of the vitelline gland are so close together that the gland appears as an irregularly ovoid mass, measuring from 0.038 by 0.063 mm. to 0.131 by 0.204 mm. Its bilobed condition is evident in older proglottides, but in gravid ones it is reduced in size and elongated.

Host: Gray fox, *Urocyon cinereoargenteus* (Schreber) collected by Dr. J. C. Howell on June 8, 1954 in Knox County, Tenn.

Type: Type specimens from the small intestine of the gray fox. To be deposited in the U. S. National Museum.

Paratypes: Specimens with same data as type in the collection of the author.

Chromosome number: $2n=14$; $n=7$.

This new species of cestode is similar to MacCallum's (1921) *M. bassarisci* in possessing distinct segmentation between the

mature proglottides and in not having all of the testes confined between the excretory canals. Chandler (1942) used these two characteristics to separate his species *M. manteri* from *M. basarisci*.

M. jonesi resembles *M. manteri* in the formation of the parauterine organ and in most of the internal and external morphology. Table 1 presents the differences between the two species. *M. manteri* is somewhat larger in its dimensions than *M. jonesi* and has a much broader scolex and neck. The number of testes as well as their arrangement in relation to the excretory ducts is also different. *M. jonesi* has only one bilobed vitelline gland. Both species have different hosts.

This species is named in honor of Dr. A. W. Jones in recognition of his generous aid and criticism in the preparation of this paper and other manuscripts.

TABLE 1. Comparison of certain taxonomic characteristics of *Mesocestoides manteri* and *M. jonesi*. (All measurements in mm.)

Name	<i>M. manteri</i>	<i>M. jonesi</i>
Body		
Length	9-16	5.5-12
Width (last segment)	1-1.25	.38-.47
Scolex		
Length	.285-.350	.195-.330
Width	.420-.490	.195-.270
Suckers		
Length	.175-.21	.11-.16
Width	.155-.18	.09-.12
Testes		
Length	.048-.05	.025-.050
Width	.048-.06	.038-.048
Number	30-45	24-32
Number outside excretory ducts	4-5	9-11
Number of segments	25-55	9-25
Cirrus pouch		
Length	.088-.14	.066-.135
Width	.088-.11	.033-.075
Ovary		
Length	.09-.11	.067-.173
Width	.07-.11	.029-.094
Egg capsule		
Length	.350-.395	.070-.216
Width	.320-.350	.060-.183
Egg Mass		
Length	.22-.26	.04-.15
Width	.245-.274	.04-.15

THE CHROMOSOME COMPLEMENT

Mitotic chromosomes were studied from the macromeres of the developing embryos and from the ovaries. Meiotic chromosomes were studied in the testes and in the maturing ova. Carnoy's fixative provided adequate fixation for this material

and iron haematoxylin stain was very efficient. The chromosomes of *Mesocestoides jonesi* are very small, all measuring less than one micron in length. There is variation in size and perhaps shape of the chromosomes, but their minuteness prohibited a more critical study of their morphology. The chromosome number was found to be seven haploid, fourteen diploid (Figs. 5, 6, and 7). No variation from this number was observed in serial sections from fourteen worms examined.

A DICEPHALIC SPECIMEN OF *M. JONESI*

Among the specimens of *Mesocestoides jonesi* obtained from the gray fox, one was observed to possess two scoleces. This is believed to be the first report of such an abnormality among the members of the genus *Mesocestoides*.

The neck of this worm is 1.15 mm. long and 0.15 mm. wide. About 0.85 mm. from the first segment a separation of the neck in two halves is noticed. This is caused by a dorso-ventral incision extending 0.3 mm. behind the junction of the scoleces and the neck, thus giving the appearance of two necks, each having a scolex (Fig. 8). The two resulting necks are about the same width (0.104 and 0.119 mm.). Each scolex has only two cup-like suckers of about the same size (from 0.113 to 0.129 mm. long by 0.87 to 1.113 mm. wide). The suckers are located along the lateral sides of the scoleces. Either scolex is smaller than others from normal worms of comparable age. The two main longitudinal canals running through the neck separate, each going to a separate scolex. Outside of this dicephalic condition the worm agrees in all respects with the other specimens of this new species.

Although the position of the genus *Mesocestoides* among the Cyclophyllidea is accepted by taxonomists, it is well known that these worms possess superficial pseudophyllidean characters. The most obvious of these characters is the presence of surficial genital pores. To this characteristic can perhaps be added the dicephalic anomaly described here, since the two-suckered scoleces would appear, superficially at least, to resemble pseudophyllidean scoleces.

SUMMARY

1. A new species, *Mesocestoides jonesi* is described from the gray fox, *Urocyon cinereoargenteus*. The worm is characterized by its small size, number and distribution of its testes, and by its bilobed vitelline gland.
2. The chromosome number of *Mesocestoides jonesi* is seven haploid, fourteen diploid.
3. A dicephalic anomaly found in a specimen of *M. jonesi* is described.

LITERATURE CITED

- Chandler, A. C. 1942. *Mesocestoides manteri* N. Sp. from a lynx, with notes on other North American species of *Mesocestoides*. J. Parasitol., 28: 227-231.
- McCallum, G. A. 1921. Studies in helminthology. Zoopath., 1: 136-284.
- Wardle, R. A. and McLeod, J. A. 1952. The zoology of tapeworms. Univ. of Minnesota Press, Minneapolis. 780 pp.
-

NEWS OF TENNESSEE SCIENCE
(Continued from Page 56)

fellowship from the American Foundation for Pharmaceutical Education to Mr. Alfred Tripp for graduate study in pharmacology, especially the action of drugs on the heart and blood vessels.

omo-
less
per-
dited
some
Figs.
d in

from
is is
g the

wide.
neck
il in-
; and
aving
same
o-like
ng by
g the
thers
ongi-
going
n the
this

g the
that
The
fficial
d the
blesces
idean

m the
erized
nd by

seven

jonesi