

# Observations on *Kalicephalus subulatus* Molin, 1861 from Nicaragua and Mexico

by

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During the summers of 1964 and 1965, several specimens of *Constrictor constrictor imperator* (= *Boa constrictor imperator*) collected in Nicaragua and Chiapas, Mexico, yielded specimens of *Kalicephalus subulatus* Molin, 1861. The material afforded good specimens for study which yielded additional information of this monoxenous, neotropical kaliceph.

## METHODS

Nematodes were removed from the intestine of the boas immediately after death of the snakes. The nematodes were killed and fixed in warm AFA (Alcohol-formalin-acetic acid) and preserved in 70 per cent ethanol. All specimens were cleared in glycerine. Specimens to be photographed were cleared additionally in lactophenol.

## OBSERVATIONS

**BODY SHAPE:** Relatively short and stout, cervical cuticle not inflated.

**HEAD:** Buccal capsule consists of two lateral valves of several pieces. Face opens anteriorly (figures 2 and 4) and is slightly tilted dorsally. Head appears asymmetrical due to triangular nature of posterior ventral piece and rounded posterior ventral piece. Anterior ridge wide with angular corners. Dorsal, lateral and ventral cervical papillae affected markedly by fixation. Papillae arise in area of esophageal bulb and extend anteriorly between anterior plates to margin of body. Dorsal gutter with anterior bend.

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**ESOPHAGUS:** Well developed, twice as long as buccal capsule, with prominent bulb. Nerve ring just anterior to isthmus. Excretory pore usually at level of widest portion of bulb but occasionally more posteriorly.

**INTESTINE:** Intestine consists of a single flattened layer of columnar epithelial cells approximately  $50\mu$  in length and  $7\mu$  in width; brush border present; nucleus located at proximal end of cell.

**FEMALE:** Vulva at posterior third of body, lips of vulva in shallow depression in immature females, raised in gravid ones. *Vagina vera* highly muscular, lined by cuticle. *Vagina uterina*, lacking cuticular lining, muscular, divided into three regions by sphincter muscles, with or without eggs. (figure 3) An additional heavier sphincter divides the *vagina uterina* into a second part, a nonmuscular proximal piece, continuous with the uterus. Proximal piece wall consists of large cuboidal cells which decrease in size distally. Uterus amphidelphic, containing many eggs in 16-or 32-cell stages of development. Ovarian coils crowded in close loops anterior to anterior uterus. Tail narrow, clongate, ending in conical point. Anus with two lips, the posterior more prominent. *Depressor ani* muscle well developed. Rectum lined by cuticle and epithelial cells, extends 0.16 to 0.20 mm in length. Intestine sacciform and intestino-rectal opening not delineated. Three rectal glands.

The eggs begin development in telogonic ovary and move into oviduct where they remain attached by the rachis. Eggs at point of entry into uterus measure 40 to  $51\mu$  wide by 48 to  $55\mu$  long. Fertilization and shell formation occur in the proximal oviduct or distal uterus. Eggs are laid in 48-cell stage. Fully embryonated eggs were found in mucus surrounding females suggesting autoinfection or that fully embryonated eggs are passed from the host. SCHAD (2) found that eggs of *K. parvus*, *K. rectiphilus* and *K. agkistrodonis*, laid in the 23 cell stage, embryonated and became infective in four to five days and occur free in the intestine of the host.

Eggs in the ovjector are ovoid 74 to  $76\mu$  long by 49 to  $51\mu$  wide. Embryonated eggs assume a spherical shape and possess a well developed external protein layer. The shell in these eggs measures 40 to  $42\mu$  and the external layer forms a light halo around the egg and measures 67 to  $72\mu$ . (figures 8, 9).

**MALE:** Slightly smaller than female. Bursa well developed, tri-lobed (figures 1 and 5). Dorsal lobe projecting beyond lateral lobe, bifurcates 0.11 to 0.133 mm from posterior end. Each trunk further divides into two parts 0.07 to 0.09 mm from posterior end. Proximal ray divides again into two equal divisions 0.04 to 0.06 mm from end, distal ray terminates undivided at margin. Externodorsal branches 0.13 to 0.14 mm from end of bursa and does not reach margin. Posterolateral, mediolateral and anterolateral (externolateral) divide from a common trunk. Mediolateral and posterolateral rays are closely approximated and possess well developed muscle fibers. Anterolateral contains fewer and weaker developed muscles and is shorter than the other two rays in this group. The ventral rays consist of two pairs, closely approximated, although split to the base. Spicules equal, long, alate, with spatulate tips. Gubernaculum and telemon present. Testis

extend anteriorly in the body, give rise posteriorly to seminal vesicle. Intestine and seminal vesicle or ejaculatory duct open just anterior to gubernaculum into a chitin-lined rectum. Two rectal glands observed.

REPRODUCTION: Males and females are present in the small intestine of the host where they adhere to the intestinal wall by strong mouth parts. Posterior end lies free in lumen of intestine. A single pair were collected and preserved *in copula* and constitute the subject matter here discussed.

The male adheres to the female by the bursa (figures 6 and 7) primarily by the rays comprising the lateral and ventral lobes. The muscular rays extend approximately one-fourth diameter around the female. Dorsal ray is flexed upward and is pressed against the body of the female. The vaginal opening in the female lies at the level of the externolateral and mediolateral rays. The spicules move forward by contraction of exsertor muscles, slide along the trough of the gubernaculum and bend dorsally by the telemon. The distal end of the telemon extends over the spicules and articulates with the gubernaculum. The spicules possess a natural curve which aids the bending. The spicules run posteriorly along the body of the female before reaching the vulva where they bend in the opposite direction to enter. They extend three fourths of the distance into the chitin-lined *vagina vera*. They occur close together throughout their length and may function here to serve as a conduit for the sperm. The tips of the spicules that enter the vagina are spread apart and serve to open the gonopore. The role of the prostatic gland could not be determined.

The measurements of *Kalicephalus subulatus* Molin from Nicaragua and Mexico\* are presented in table 1.

TABLE 1.

*Measurements of Kalicephalus subulatus (in mm)*

Sex	10 males	10 females
Total length	7.12 — 8.52	8.16 — 10.13
Greatest width	0.27 — 0.29	0.23 — 0.28
Dorsoventral diameter of head	0.18 — 0.23	0.19 — 0.23
Depth of buccal capsule	0.18 — 0.20	0.19 — 0.24
Nerve ring	0.31 — 0.35	0.30 — 0.32
Excretory pore	0.48 — 0.50	0.44 — 0.45
Length of esophagus	0.41 — 0.46	0.36 — 0.40
Width of bulb	0.21 — 0.23	0.22 — 0.24
Spicule length	0.61 — 0.63	
Gubernaculum length	0.23 — 0.25	
Telemon length	0.04 — 0.06	
Vulvar ratio*		1.88 — 1.93
Anus from posterior end of body		0.21 — 0.25

\* Ratio equals prevulvar body length divided by postvulvar body length.

\* The respective localities are 13 km. S. 14 km. E. Rivas, 40 meters, Nicaragua and (Sabana de) San Quintin, 215 meters, Chiapas, Mexico.

## DISCUSSION

*Kalicephalus subulatus* was described from the boa constrictor, *Constrictor constrictor*, in Brazil by MOLIN (1). Since his description, additional kalicephs have been described from this host collected either in zoos or in naturally occurring circumstances. With the exception of a single collection of *Kalicephalus costatus* from "cobra imperator" (probably *Constrictor constrictor imperator*) in Costa Rica, all kalicephs reported have been placed in synonymy with *K. subulatus*, reviewed by SCHAD (3). The species is now known from Venezuela, Brazil, Costa Rica and Guatemala. This report adds Nicaragua and Mexico.

We follow SCHAD in believing that the Diaphanocephalidae arose in the Triassic, the *Kalicephalus* branch radiating during the Cretaceous. The few species of kalicephs parasitising lizards and the lack of radiation in *Diaphanocephalus* suggests later evolution of this group.

## ACKNOWLEDGMENT

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## SUMMARY

*Kalicephalus subulatus* Molin, 1861, collected in Nicaragua and Chiapas, Mexico, from *Constrictor constrictor imperator* is reported and observations made on the morphology and reproduction in this nematode.

## RESUMEN

Se da a conocer la presencia de *Kalicephalus subulatus* Molin, 1861 en la boa *Constrictor constrictor imperator* de Nicaragua y Chiapas, México. Los autores hacen algunas consideraciones sobre la morfología y la reproducción del nemátodo.

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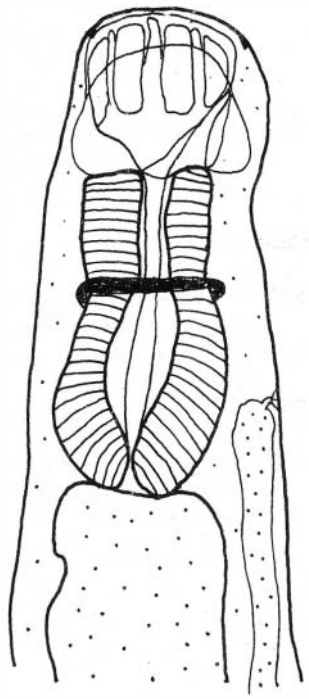
Figure 1. *Kalicephalus subulatus* Molin, 1861. Bursa of male.

Figure 2. Anterior end of female.

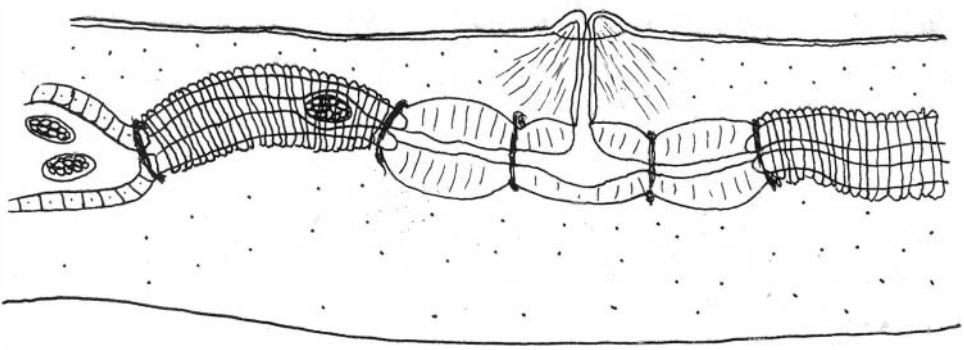
Figure 3. Region of vulva showing ovijector.



.28



.40



3

.23

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Figure 4. Photomicrograph of *Kalicephalus subulatus*. Anterior end of female. Scale equals 0.25 mm.

Figure 5. Photomicrograph of bursa and spicule position for copulation. Scale equals 0.25 mm.

Figure 6. Photomicrograph of *Kalicephalus subulatus* "in copula". Male is separated slightly from female due to coverslip pressure. Scale equals 0.25 mm.

Figure 7. Photomicrograph of spicule within vulva of female. Scale equals 0.04 mm.

Figure 8. Photomicrograph of eggs adhering to mucus on female *Kalicephalus*. Scale equals 0.04 mm.

Figure 9. Photomicrograph of egg. Scale equals 0.04 mm.

