

Bull. Iraq nat. Hist. Mus.
(2010) 11 (1):27-38

FIRST RECORD IN IRAQ OF *TANQUA ANOMALA* (LINSTOW, 1904)
FROM THE DICE SNAKE, *NATRIX TESSELLATA TESSELLATA*
(LAURENTI, 1768)

Azhar A. Al-Moussawi
Iraq Natural History Museum, Baghdad University, Baghdad, Iraq
Bab Al-Muadham, P.O. Box 59038

ABSTRACT

Tanqua anomala (von Linstow, 1904) specimens were recovered, from the lining wall of the gastro-intestinal tract of the dice snake *Natrix tessellate tessellate* (Laurenti, 1768) collected in Baghdad city, central Iraq. Measurements of the males, females and a comparison of the nematode with other studies tabulated. Reporting of *Tanqua anomala* from this snake represents the first record for Iraq as well as a new host record.

INTRODUCTION

Reptiles are commonly infected by a wide range of parasites, serving either as their definitive or intermediate hosts.

Reptiles of Iraq encountered a hundred species, including forty one species of snakes (Reed and Marx, 1959; Mahdi and George, 1969; Afrasiab, 1987; Afrasiab and Ali, 1988; 1989 a, b and Leviton *et al.*, 1992). Surprisingly, little attention had been paid to their parasites, the papers on parasitic fauna of Iraqi reptiles are rather few and fragmentary.

Marinkelle and Al-Mahdawi (1980) described the Protozoan *Trypanosoma turcici* from the gecko *Hemidactylus turcicus*. Al-Barwari and Nassir (1983) recorded the nematode *Thelandros* sp. from *Hemidactylus flaviviridis* and *H. Persicus*. Kugi and Mohammad (1988) described the cestodes: *Oochoristica nupta* from the lizard *Agama nupta* and isolated *Oochoristica agama* from *Uromastix microlepis*. Hassan and Abdullah (1989) isolated the cestodes: *Oochoristica truncata* from *Agama rudrata* and *Ophisops elegans*; the cestode *Oochoristica tuberculata* and the two nematodes *Thelandros micipsae* and *Thelandros* sp. were isolated from *Ceratopodium scaberium* (= *Gymnodactylus scaber*). Salih and Rahemo (1989) recovered Cysticeroid of *Joyeuxiella* sp. from the wall lizards: *C. scaberium* and *Phyllodactylus elisae*. Rahemo and Ami (1993) isolated the cestode *Ophiotaenia europea* from *Natrix tessellata*. Fattohy and Al-Zubaidy (1994) reported the protozoa *Balantidium duodeni* from *Hemidactylus flaviviridis* and the Cysticeroid of the genus *Joyeuxiella* from *Trapelus* (= *Agama*) *rudrata*; *H. flaviviridis*; *Ophisops elegans* and *Phyllodactylus elisae* and *Thelandros micipsae* from *T. rudrata*; *C. scaberium*; *H. flaviviridis* and *O. elegans*; and *Thelandros* sp. from *T. rudrata*; *C. scaberium* and *O. elegans* and the nematode *Salobrella* sp. from *C. scaberium*; *H. flaviviridis* and *O. elegans*. Al-Hadithi and Abdl-Majeed (1989)

First Record in Iraq of *Tanqua nomala*

recovered the nematodes, *Pharyngodon laevicauda* from *H. turcicus*, *Thelanderos micipsae* from *C. scaberium*; *H. flaviviridis* and *Physalopteroid* sp. from *H. turcicus*. Al-Zako (1999), reported four nematodes from three reptilian hosts: *Camallanus* sp. from the tortoise *Testudo graeca*; *Neopharyngodon* sp. from the geckos *C. scaberium* and *Thelandros vittata* and *Trispiculascaris* sp. from the lizard *Mabuya vittata*. Al-Saadi (2002) isolated the nematodes: *Thelandros micipsae* from *C. scaberium*; *H. flaviviridis* and *H. turcicus*; *Thelandros* sp. from *H. turcicus* and *C. scaberium* and the nematode *Neopharyngodon* sp. from *H. flaviviridis* and *C. scaberium*. Among four reptilian hosts Al-Hashimi (2006) reported six parasites, two trematodes: *Telorchis cyclemmids* from *Mauremys (=Clemmys) caspica* and *Bilorichis indicum* from *Rafetus euphraticus*; two cestodes *Oochoristica* sp. and *Crepidobothrium* sp. from *Natrix tessellata* and two nematodes *Camallanus* sp. and *Trispiculascaris* sp. from *Mabuya aurata*. From seven species of Iraqi reptiles, nine species of helminthic parasites were encountered by Al-Barwari and Saeed (2007), the digenetic trematode *Telorchis stunkardi* from the turtle *Mauremys c. caspica*; the cysticeroid of *Diplopylidium nolleri* from the geckos: *Asaccus elisae*, *Hemidactylus flaviviridis*, *H. persicus* and from the snake *Spalerosophis d. cliffordi*; and 7 nematode species, *Angusticaecum holopterum* and *Atractis dactyluris* from the tortoise *Testudo g. Iberia (= terrestris)*; *Camallanus microcephalus* from *Mauremys c. caspica*; *Falcaustra japonensis* from the turtle *Rafetus (=Trionyx) euphraticus*; *Tachygonetriania colleri* from *Testudo g. terrestris*; *Thelandros* sp. From *Acanthodactylus elisae*, *H. flaviviridis*, *H. persicus* and *Microtetrameres* sp. from *H. flaviviridis*.

The nominate dice snake, *Natrix tessellate tessellata* (Laurenti, 1768), distributed from Middle and Southern Europe through Western Asia to western China including India, Persia, Iraq, Syria and Egypt (Boulenger, 1920; Arnold and Burton, 1978 and Baran and Ataturk, 1998). It is present throughout Iraq with remarkably wide distribution in rivers, lakes, channels and marshes (Khalaf, 1959 and Mahdi and George, 1969). The studies of parasite communities of this snake in Iraq are rare and scanty. This paper deals with recording the nematode *Tanqua anomala* from the gastro-intestinal tract of this snake for the first time in Iraq and it also constitutes a new host record as well.

MATERIALS AND METHODS

A total of 28 adult specimens of the Dice snake *Natrix tessellate tessellate* were collected at Diyala Bridge, Baghdad City, Central Iraq during the period January to November 2008. The snakes were transferred to the laboratory alive, sacrificed and dissected as soon as possible. All viscera were removed and each placed in Petri dish with normal physiological saline. The recovered nematodes fixed and stored in 70% alcohol and cleared by lactophenol. Helminth identification was based on (Yamaguti, 1961; York and Maplestone, 1962).

All measurements of the nematodes are with millimeters (mm) unless otherwise stated. Images were taken with digital camera; drawings were made with aid of a camera Lucida. Helminth specimens were deposited in the collection of Iraq Natural History Research Center and Museum \University of Baghdad \ Baghdad \ Iraq.

RESULTS AND DISCUSSION

Gnathostomidae

Genus: *Tanqua* Blanchard, 1904

Tanqua, R. Blanchard, 1904 (= *Ctenocephalus*, v. Linst., 1904) (Baylis, 1916).

Tanqua anomala (v.Linst.) Baylis, 1916

Tanqua anomala (Linstow 1904)

Synonyms: *Heterakis anomala* vonLinstow, 1904 (Baylis, 1939)

Blanchard (1904) erected the genus *Tanqua* to accommodate the nematode *Ctenophorus tiara* (originally named *Ascaris tiara*). Baylis (1916) reviewed and amended von Linstow's description of *T. tiara*, described *T. anomala* and confirmed that *T. diadema* Linstow, 1904 was a valid species, and gave a key to separate between *T. tiara* and *T. diadema*.

The species belong to the genus *Tanqua* were identified in several monitors (Jacobson, 2007). Worldwide, nine species of this genus have been described from reptilian and amphibian hosts: *Tanqua bainaie*; *T. geoclemydis*; *T. gigantea*; *T. herpestis*; *T. oclusa*; *T. ophidis*; *T. tiara*; *T. sindensis* and *Tanqua* sp.

Twenty males and eighteen females of *Tanqua anomala* were collected from the gastrointestinal tract of 28 snakes. The worm is of medium size found embedded its head in the inner mucous lining wall of the gastro-intestinal tract of the snake. Head with two relatively large lips, dorsal and ventral, each bearing on its inner side three rounded tooth-like projections, head-bulb is relatively small, divided externally into two swellings separated by lateral longitudinal grooves, the head bulb is provided with rows of thorn-like spines which help this nematode to attach with the host tissue, that makes its removal rather difficult. There is a cuticular collar behind the head-bulb, there are four elongated cervical sacs extend from anterior margin of cervical collar they appear to open separately upon the surface of the swellings at the base of the lips, the esophagus long, simple slender increasing gradually in diameter posteriorly (Fig. 1 A&B) Posterior end of the body provided with series of muscle-bands on each side of the ventral surface, ending at front of the anus.

Measurements of 20 male and 18 female worms were done with an ocular micrometer and means were tabulated.

Male Fig. (2): Twenty males were isolated from the gastrointestinal tract of the snake, the body is attenuated towards the posterior ends. On the tail there are eight pairs of ventro-laterally sessile caudal papillae, they are different in sizes: three preanals, one adanal and four Postanals, the last pair is very small; the largest pair is the seventh from posterior end. The two curved ventrally spicules are with blunt ends, they are similar, equal in length and spiny, tail tapering to point with caudal alae.

Female: Fig. (3): Eighteen females were isolated from the snake. They are larger than males. Posterior end of the body has a short tail, which bears a pair of papillae, the vulva is nearer for the posterior end, it situated at about the posterior third of the body, oviparous, eggs oval, with thin shells and fine granulations, tail is short, tapering and pointed.

First Record in Iraq of *Tanqua nomala*

Table 2 shows a slight differences in present nematode measurements from that of Baylis (1939) and Dewi *et al.*,(2008), it could be due to the difference of host species and their habitat ecosystems since the nematodes of Baylis (1939) were isolated from the water snake *Tropidonotu spiscator* in India and Ceylon and specimens of Dewi *et al.*, (2008) were isolated from the intestine of the semi-aquatic snake *Acrochordus javanicus* in south Sumatra/Indonesia.

The description of *T. anomala* by Baylis (1916) was brief for the nematode which isolated from the stomach of *Tropidonotu spiscator* in ceylon, and confirmed that *T. diadema* Linstow, 1904 is a valid species for *T. anomala*, and gave a key to separate between *T. tiara* and *T. diadema*. In 1939 from the same host in India and Ceylon Baylis described *T. anomala* and gave detailed descriptions and dimensions for males and females.

Table.1: Measurements of *T. anomala* (von Linstow, 1904)Baylis1939; Dewi *et al.*,2008 and the present study.

Measurements	<i>T. anomala</i> (Baylis, 1939)	<i>T. anomala</i> (Dewi et al., 2008)	<i>T. anomala</i> (present study)
Body length ♂	26.5 – 50.0	25.0 – 39.5	30 (12-42)
♀	30.1 – 56.0	33.6 – 43.9	38 (27-50)
Body maximum width ♂	0.8-2	0.49– 0.89	0.79 – 1.09
	0.95-2	0.67–0.94	0.89 -1.22
Oesophagus ♂	3.0 – 5.3 (not separated between	3.224 – 5.798	2.882- 3.118
♀	♂ and ♀)	3.454 –4.238	3.575- 4.195
Spicules	1.3 – 1.7	0.745 – 1.326	0.520-1.65
Vulva (from posterior	1/3	1/3.72	1/3.44
Eggs (µm)	65 x 50	50 x 38	70 x 50

This worm was reported from the water snake *Natrix piscator* (= *Tropinodonotus piscator*) (Baylis,1939;Sinha and Sahay, 1972; Soota and Chaturvedi, 1974; Rao *et*

A. A. Al-Moussawi

al., 1977; Naidu, 1978; Kalyankar and Kankal, 1980; Lakshmi, *et al.*, 1985 and Kankal, 1989) from the snake *Natrix stolatus* (Soota and Chaturvedi, 1973; Saharan and Sinha, 1974), Nama (1974) reported a single immature female *Tanqua anomala* from the body-cavity of amphibian host *Rana tigrina*. From the snake *Cerberus rhyncopus* it was isolated in Pakistan (Bilqees and Rehana, 1975), from the stomach of *Natrix* sp. by Gupta and Duggal (1981) and in India from the colubrid snake *Atretium schistosum* by Lakshmi *et al.* (1985).

Table 2 shows that females generally larger than males.

Recently Dewi *et al.* (2008) isolated and redescribed *T. anomala* from the intestine of the semi-aquatic snake *Acrochordus javanicus* in south Indonesia and to resolve the confusion of the status of *T. anomala* and to clarify the taxonomic position of the two species (*T. anomala* and *T. ophidis*) they used the scanning electron microscopy (SEM), and as a result of comparison between these two species according to the morphological features they confirmed that *T. anomala* as a valid species and *Tanqua ophidis* Johnston & Mawson, 1948 falls in synonymy with it. This agrees with Gupta and Duggal, (1981) who regarded that *T. ophidis* is as junior synonym for *T. anomala*.

Table.2: Means of measurements for males and females of *T. anomala* (von Linstow, 1904).

Measurements	Males	Females
Body (L x w)	30 x 7.0	38 x 1.0
Head (L x w)	0.23 x 0.25	0.25 x 0.30
Oesophagus(L x w)	3.0 x 0.40	3.7 x 0.44
Cervical sac (L)	0.50	0.54
Excretory pore from anterior end	0.72	0.83
Nerve ring (L x w)	0.09 x 0.18	0.09 x 0.19
nerve ring from anterior end	0.40	0.44
Spicule	1.08	-
Eggs (L x w) (µm)	-	70 x 50
Vulva (from posterior end)	-	13
Tail(L)	0.60	0.80

ACKNOWLEDGEMENTS

The author would like to thank Kartika Dewi and Amir Hamidy from the Museum Zoologicum Bogoriense, Bogor/ Indonesia, to Dr. Isam Saeed from the University of Copenhagen / Denmark, and to Prof. Farhan T. Mhaisen for sending papers.

From Iraq Natural History Research Center and Museum / University of Baghdad, the author is very grateful to Prof. Mohammad K. Mohammad, the director, for supporting the diagnosis of nematodes, Khalida Ibrahim for her kind assistance in laboratory work and to Mohammad I. Ghazwan, for collecting the snakes.

LITERATURE CITED

- Afrasiab, S.R. 1987 First record of *Stenodactylus affinis* (Murray) marsh geckos (Reptilia: Gekkonidae) in Iraq. *J. Biol. Sci. Res.* 18 (1):231-233.
- Afrasiab, S.R. and Ali, H.A. 1988. A new record of toad *Bufo surdus* Boulenger (Amphibia, Bufonidae) from Iraq, with a preliminary key for Iraqi amphibian. *Bull. Iraq Nat. Hist. Mus.* 8: 115-123.
- Afrasiab, S.R. and Ali, H. A. 1989. A report on a collection of reptiles from Rumaila Desert, south of Iraq. *Bull. Iraq Nat. Hist. Mus.* 8(2): 65 – 73.
- Afrasiab, S.R. and Ali, H.A. 1989b. A new record of the snake *Lytorbychu skenedyi* Schmidt (Reptilia: Colubridae) from Iraq. *Bull. Iraq Nat. Hist. Mus.* 8(2): 157-159.
- Al-Barwari, S.E. and Nassir, J.K. 1983. First record of ten species of helminthic parasites from vertebrates in Iraq. *Iraqi J Science*, 24: 101-108.
- Al-Barwari S.E. and Saeed, I. 2007. On the helminthfauna of some Iraqi reptiles. *Türkiye Parazitoloji Dergisi*, 31(4): 330-336.
- Al-Hadithi, I.A.W. and Abdl-Majeed, M. I. 1989. Some helminth parasites from jeckos in Basrah, Iraq. *Al-Mustansiriya J. Sci.* Vol. 9(1): 19-22.
- Al –Hashimi, S.F.A. 2006. Parasitic worms of alimentary canal of some reptile species in Al-Ramadi city. Msc. thesis. Edu. Univ. Al-Anbar: 77pp. (in Arabic)
- Al-Saadi, A.A.J. 2002. Incidence of three nematode species from the digestive tract of three lizard species in Baghdad city. *Diyala Journal*, 13: 385-391.
- Al-Zako, S.S.H. 1999. A survey on intestinal nematodes of some amphibians and reptiles in Ninevah province with special reference to the histology of *Ascaridiagalli* (Schrank, 1788) Freeborn, 1923. Ph.D. thesis, Edu. Univ. Mosul: 193 pp. (in Arabic)

A. A. Al-Moussawi

- Arnold, E.N. and Burton, J.A. 1978. A field guide to the reptiles and amphibians of Britain and Europe, Collins, London: 272 pp.
- Baran, I., and Ataturk, M. K. 1998, Turkish Herpetofauna (Amphibians and Reptiles). Publication Board of the Ministry of Environment, Ankara, Turkey: 214 pp.
- Baylis, H. A. 1916 The nematode genus *Tanqua* R. Blanchard. Annals and Magazine of Natural History, series 8, vol.17: 223–232.
- Baylis, H.A. 1939 The Fauna of British India. Nematoda', vol.2 (Filarioidea, Diocotophymoidea and Trichinelloidea). Taylor and Francis, London, :198–202.
- Bilqees, F. M. and Rehana, R. 1975 A record of helminth parasites from snakes of Sind, Pakistan. Acta Parasitologica Polonica Vol.23 No. 41/51: 485-492.
- Blanchard, R. 1904 *Tanqua*, n. g., remplaçant *Ctenocephalus* von Linstow. Archives de Parasitologie, 8: 478.
- Boulenger, G.A. 1920. A list of snakes from Mesopotamia collected by members of the Mesopotamian expeditionary force, 1919 to 1920. Journal of Mombay Natural History Society. Vol.27 No.2: 25-28.
- Dewi, Kartika, Jones, Hugh, and Hamidy, Amir 2008. The Status of *Tanqua anomala* (Von Linstow, 1904 (Nematoda: Gnathostomatoidea) Transactions of the Royal Society of South Australia, Volume 132, Number 1, May , pp. 7-13(7)
- Fattohy, Z.I. and Al-Zubaidy, A.B. 1994. Parasites of some lacertidae in Baghdad province, Iraq. J. Educ. sci. Vol. 18: 12-25 (in Arabic).
- Gupta, N. K. and Duggal, C. L. 1981. On the redescription of *Tanqua anomala* (V. Linstow, 1904) Baylis, 1916 (Nematoda: Gnathostomatidae) and discussion on the synonymy of *T. ophidian* Johnston and Mawson, 1948. Research Bulletin of the Panjab University, Vol. 30 (1-4): 61-64.
- Hassan, I.S. and Abdullah, I.A. 1989. Helminth parasites of the digestive tract of lizards in Ninevah district, Iraq. J. Educ. and sci. Vol.9:88-99.
- Jacobson, E.(Ed.) 2007. Infectious diseases and pathology of reptiles: color atlas and text. University of Florida College of Veterinary Medicine Gainesville, Florida. CRC Press, Taylor & Francis Group, LLC, 716 pp.

First Record in Iraq of *Tanqua anomala*

- Kalyankar, S. D. and Kankal, N. C. 1980 Preliminary study on the effect of diet deficiency of certain biochemical compounds on the host infected by the nematode parasite. *Rivista di Parassitologia* Vol. 41 No. 2 pp. 165-169.
- Kankal, N. C. 1989 Histochemistry of *Tanqua anomala* a nematode parasite of water snake *Tropidonatu piscator*. *Rivista di Parassitologia*, 4 (48), 2, pp 175-184
- Khalaf, K. T. 1959. Reptiles of Iraq with some notes on the amphibians, Ar –Rabitta Press, Baghdad,: 96 pp.
- Kugi G. and Mohammad, K. 1988 Cestodes of the genus *Oochoristica* from Iraqi lizards. *Jps. J. Parasito.*, 37(6): 405-409.
- Lakshmi, B.B., Hanumantha, Rao, K. and Shyamasundari 1985. 'The nematode fauna from reptiles of Andhra Pradesh.' *Indian Journal of Helminthology (New Series)*, Meerut 2(1&2): 115-125.
- Leviton, A.E.; Anderson, S.C., Adler, K. and Minton, S.A. 1992. Handbook to middle east amphibians and reptiles. Society for the study of amphibians and reptiles: 252 pp.
- Mahdi, N. and George, P.V. 1969 A systematic list of vertebrates of Iraq. Iraq Natural History Museum, Publication, No. 26. University of Baghdad, Al-Awqat Press: 104 pp.
- Marinkelle, C.J. and Al-Mahdawi, S.K. 1980. *Trypanosoma turcici* sp. n. (Trypanosomatida) from the Mediterranean gecko, *Hemidactylus turcicus* from Iraq. *Bull Nat. Hist. Res. Centre*, 7: 73-79.
- Naidu, T. S. V. 1978. Observations on tissue changes caused at the sites of attachment of the nematodes, *Tanqua anomala* and *Dispharynx nausta*. *Current Science* pp. 788-789.
- Nama, H. S. 1974. On the occurrence of *Tanqua anomala* (Nematoda: Gnathostomatidae) from *Rana tigrina*. *Journal of the Zoological Society of India*, Vol. 25 (1/2): 157-158.
- Rahemo, Z.I.F. and Ami, S.N. 1993 *Ophiotaenia europea* (Cestoidea: Protocephalidae) from water snake *Natrix tessellata* in Iraq. *Mutah Journal for Research and studies*. Vol. 8(3): 101 – 110.
- Rao, K. H., Shyamasundari, K. and Kumari, B. V. 1977. On nematode cleavage pattern with special reference to *Tanqua anomala* (V. Linstow, 1904)

A. A. Al-Moussawi

(Gnathostomatidae) from the water snake *Natrix piscator* Schneider. Current Science. 46 (16) 565-566.

Reed C. A. and Marx, H. 1959 A Herpetological Collection from Northeastern Iraq. Transactions of the Kansas Academy of Science, Vol. 62 (1): 91-122.

Saharan, R. K. and Sinha, R. M. P. 1974 On the occurrence and heavy infection of a spirurid nematode *Tanqua anomala* (Von Linst) in a new host. Indian Journal of Helminthology, 24 (2): 2165-67.

Salih, N.E. and Rahemo, Z.I.F. 1989. Cysticeroid of *Joyeuxiella* sp. from the wall lizards in Iraq with special reference to its cyst wall. Rivista Parasitologia, 6: 239-244.

Sinha, A. and Sahay, U. 1972. On the redescription of *Atrophocaecum indicum* Simha, 1958 (Acanthostomidae Poche, 1926; Emend. Nicoll, 1935). Indian Journal of Animal Research, 6 (1): 39-41.

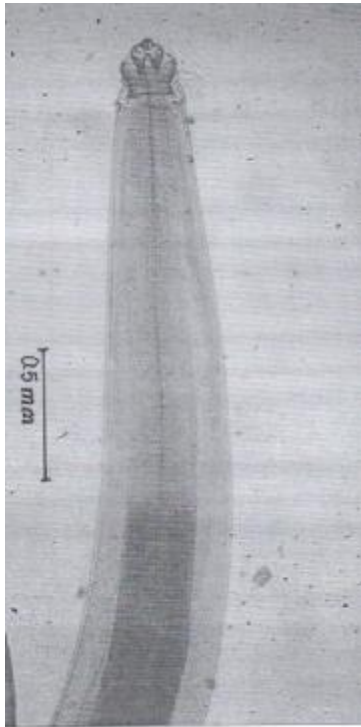
Soota, T. D. and Chaturvedi, Y. 1973. Systematic studies on some more nematodes from the unnamed collections of the Zoological Survey of India. Records of the Zoological Survey of India. 67(1/4): 121-137.

Soota, T. D. and Chaturvedi, Y. 1974. The nematode fauna of Goa. Pt. II. Indian Journal of Helminthology. Vol. 24 No. 1: 22-35.

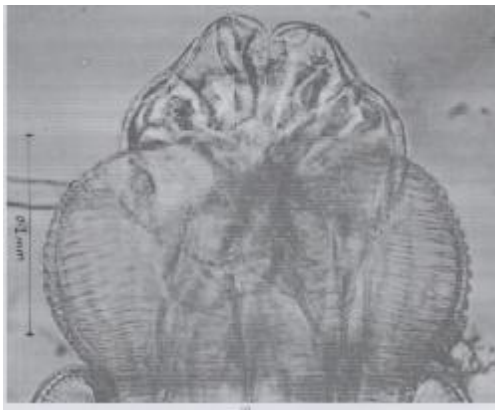
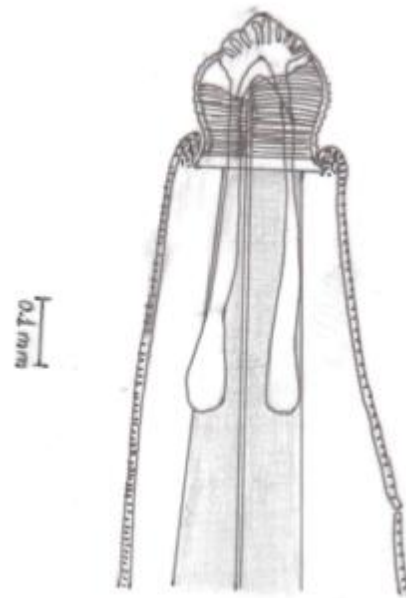
Yamaguti, S. 1961 Systema Helminthum Vol.3 The nematodes of vertebrates. Intersci. Pub. Inc., New York, 779 pp.

York, W. and Maplestone P.A. 1962. The nematode parasites of vertebrates. Haf. Pub. Com., New York: 536 pp.

First Record in Iraq of *Tanqua nomala*



-A-



-B-

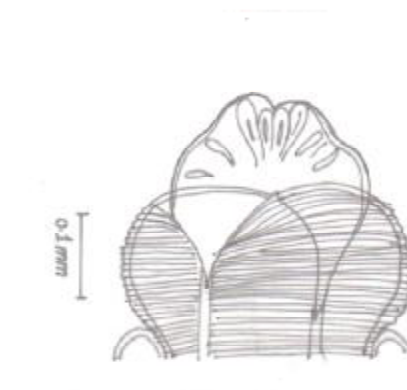


Fig.1:
A- Anterior end of *Tanqua anomala*.
B- Head –bulb.

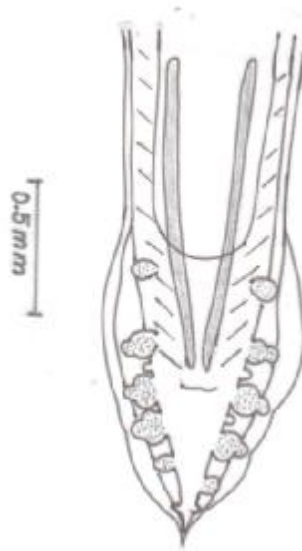
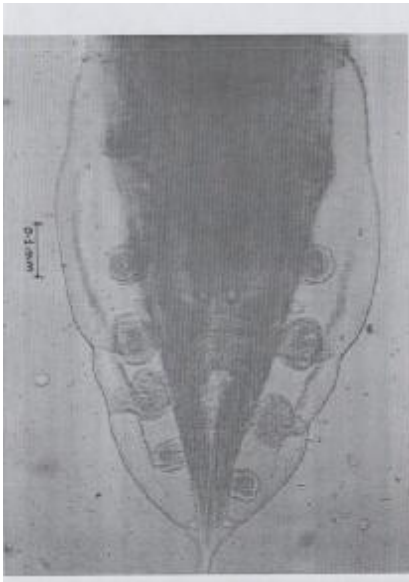


Fig. 2: Posterior end of male *Tanqua anomala*.

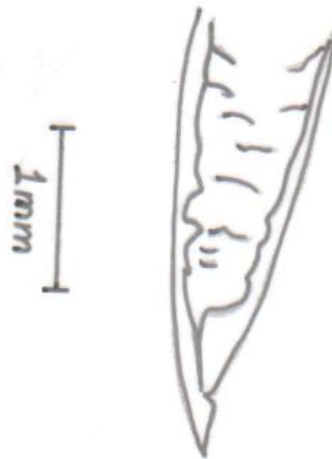
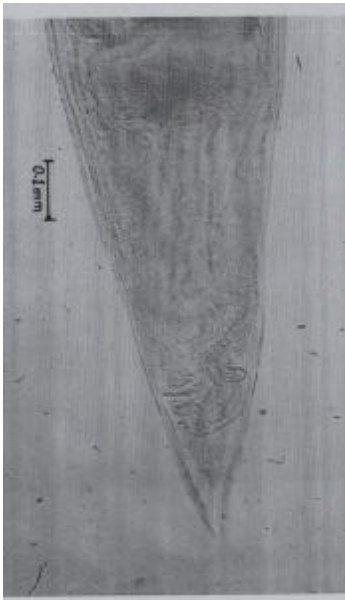


Fig. 3: Posterior end of female *Tanqua anomala*

First Record in Iraq of *Tanqua nomala*

Bull. Iraq nat. Hist. Mus.
(2010) 11 (1): 27-38

تسجيل لأول مرة في العراق (*Tanqua anomala* (Linstow, 1904) شنن م
المدورة

الماء (*Natrix tessellata tessellata* (Laurenti, 1768)

أزهار أحمد الموسوي
مركز بحوث و متحف التاريخ الطبيعي
جامعة بغداد- بغداد – العراق
البريد الإلكتروني: ahmeda_09@yahoo.com

الخلاصة

تم عزل الدودة المدورة من الغشاء المبطن للقناة الهضمية لحية حنش الماء *Tanqua anomala* من مدينة بغداد وسط العراق. تم وصف هذه المدورة ومقارنة القياسات بين الجنسين كما تمت مقارنتها مع القياسات المذكورة لها في الدراسات العالمية السابقة. يعتبر تسجيل هذه المدورة هو الأول في العراق كما سجلت في هذه الدراسة الحية كمضيف جديد لها.