Taxonomic status of *Lytocestus alii Sawarkar* 2012: A critical study

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Abstract: Sawarkar (2012) reported a new species of *Lytocestus* (*L. alli*) from fresh water fish *Clarias batrachus* Bleeker (1862), a fish from Amravati, Maharashtra. The present authors found a number of errors in the description of the worm. These errors have been pointed out. Besides *L.alli* has already been described by Jadhav & Gavahne in the year 1991. Duplication of name is not permitted by International rule of nomenclature. The authors have reasons to consider *L.alli* (?) of Sawarkar to be a homonym of *L.alli* Jadhav and Gavahne (1991). Since the species (*L.alli*) described by Jadhav and Gavahne (1991) is a synonym of *L.indicus* Moghe (1925)- Ash (2011) therefore *L.alli* should also fall in the above synonymy with *L.indicus* Moghe (1925).

Keywords: *Lytocestus alii, Clarias batrachus*, mistakes, validity.

INTRODUCTION

Sawarkar (2012) described a new *Lytocestus* species from the intestine of *Clarias batrachus* at Amravati Maharashtra. The above species is supposed to have characteristics of the family Lytocestidae Wardle & McLeod (1952) and the description of the worm has been shown to posses the following features:

(1) The worm has been shown to posses 500-900 testicular follicles, are preovarian scattered in the central medullary region but arranged in 9-11 rows in a single field, evenly distributed. The follicles are oval and measure 0.053/0.022 to 0.121/0.080 in length and breadth.

(2) "Cirrus pouch is oval, transversely placed & measures 0.833/0.1473-0.196 in length & breadth".

(3) "Ovary is bilobed, having loose masses of two lobes, each connected by isthmus the ovarian follicles are numerous (32-39) in numbers, situated near the posterior region of the worm. Right lobe is having 4-5 rows of ovarian follicles and the left lobe is having 8 rows of ovarian follicles. It measures 0.037/0.030 to 0.090/0.030-0.045 in length and breadth".

(4) Vagina: "is curved, coiled tube, starts from genital pore, runs posteriorly in the middle and open in ootype". It measures 1.136 x 0.015, dilates in anterior 1/3 part & forms spindle shaped receptaculum seminis, which measures 0.386/0.053-0.058 in length & breadth".

(5) "Uterus is wide convoluted tube, coiled. Coils are transversely and antro-posteriorly situated & open separately by uterine pore. It measures 3.045 in length & 0.075-0.0475 in breadth. The uterine pore is large, oval with thick border, obliquely situated & measures 0.242/0.151 in length and breadth".

(6) Ootype is large, oval situated posterior to isthmus & measure 0.148/0.151 in length & breadth.

(7) "Vitellaria are follicular, oval in shape smaller than testis, subcorticular in position" lateral to testes, preovarian, extend laterally up to the base of the head arranged in 3-4 rows and measures 0.037/0.022 to 0.090/0.088 in length and breadth respectively.

The aim of this study is to assess if *Lytocestus alii* Sawarkar (2012) is a valid species or not.

Materials & Methods

Several research papers have been consulted.

Observations and Discussion

The author observed testicular follicles arranged in 9-11 rows, their number being 500-900. The diagram (B) on page 283 *Jour. Biol. & Life Sciences* does not show testicular follicles arranged in 9-11 rows rather the follicles are evenly distributed. The number of testicular follicles cannot form the basis for species proposition, although a number of keys have been proposed by Jadhav, Bhure and Padwal (2008): Solunke Fadke, Borde & Jawle (2012) & Jawle & Borde (2017) based on the number of testicular follicles. These have already been negated by Sahay, Khalkho, Singh and Mandal (2019) on sufficient grounds as under:

(1) The range of testicular follicles depict that the worm studied were not of the same age. If the worms are of the same age, the testicular follicles should normally be constant for a species.

(2) The range 230-270 of *L.indicus* Moghe (1925) falls in the minimum maximum range of 190-400 given for *L. attenuatus* Tandon *et al.* (2005).

The range of 460-480 of *L.alli* Jadhav *et al.* (1991) fits very well in the range 400-500 given for *L.follicularae* Bhure *et al.* (2010). It is surprising to note that Sawarkar (2012) proposed *L.alli* nom.nudum for his worms recovered from *Clarias batrachus* at Amravati Maharashtra. Same name cannot be given or duplicated as per norms of the nomenclature as such the latter becomes a nom.nudum.

Such nomenclatural mistakes are often committed by authors who do not have access to earlier works but mistakes are mistakes, not acceptable to the scientific communities.

The minimum of *L.shindae* Khadap *et al.* (2004) is the maximum of *L.osmanabadensis* Bhure *et al.* (2010).

The testicular follicles range 1000-1100 for *L.indica* has been mentioned by Deshmukh *et al.* (2015)[12]. The maximum range 1100, falls within the range of *L.nagapurensis* (1000-1150) or 1200 Lakhe *et al.* (2004).

The testicular follicles number 700 for *L.murhari* Kaul *et al.* (2010) fits in the range 700-800 given for *L.clariasae* Jadhav *et al.* (1991).

The maximum range of 600 of *L.naldurgensis* Kadam *et al.* (1998) fits very well with the minimum of 600 of *L.murhari* Kaul *et al.* (2010).

The range 1425-1475 for *L.govindae* Patil *et al.* (2002) fits very well in the range 1400-1500 given for *L.punensis* Jadhav *et al.* (2008).

Likewise there are so many examples. A pertinent question arises, if an investigator gets specimens of *Lytocestus* having testicular follicles ranging between 232-250 where he would place the worm with *L.indicus* or with *L.attenuatus*?

As such the authenticity of the number of testicular follicles become questionable and cannot be given cognisance for species separation/identification as suggested earlier by Sahay, Singh and Saxena (2018) too (vide *Trends in Parasitology* 2018 pp.1-7 to which the present authors are in agreement.

Cirrus pouch – Transversally or obliquely placed does not carry any meaning from the functional point of view. Of course "size" had it been extraordinarily large & its displaced position (far away from ovarian commissure anterior or from the posterior end of the worm) carries some sense.

Ovary – Right ovarian lobes with 4-5 rows of ovarian follicles and left lobe with 8-rows of follicles are not shown in the diagrams provided by Sawarkar (2012) while describing the species. Even if it is taken to be a true observation (not shown in diagram) then it means left ovarian lobe is comparatively large than the right ovarian lobe.

The position of the ovary matters for example in the genera *Pliovitellaria* Fischthal (1951) and *Wenyonia* Woodland (1923) ovary is near the middle of the body contrary to rest of the Caryophyllaeids (Lytocestidae sps) where it is by and large clearly posterior.

The shape of the ovary too carries meaning as it clearly separate one from another, having the shape of a 'dumb bell' (in *Archigetes* Leuckart (1878) *Hunterella* Mackiewicz & McCrae (1962) butterfly (*Breviscolex* Kulakovaskaja (1962), or letters "U" (*Spartoides* Hunter, 1929), "V" (*Bialovarium*, Fischthal, 1954) inverted "A" (Caryophyllaeids Nybelin, 1922) or some variation of "H" (*Psedolytocestus*, Hunter, 1929) & many other.

"Rarely two different forms of ovary occur in the same genus: an exception is *Isoglaridacris* Mackiewicz, 1965 which has both inverted 'A' and normal 'H' morphology"- Mackiewicz, (1965a & 1968b).

In *Lobulovarium longiovatum* Oros *et al.* (2012) "ovary is H-shaped with several asymmetrical, irregular lobes on dorsal and ventral sides, unite at ovarian isthmus at the level of posterior third of lobes, 0.368-1.122 wide with lateral arms 288-992 long & 111-353 wide, connected by ovarian isthmus".

Mackiewicz (1972) holds that "Between the distinctly follicular and compact types many intermediate conditions exist". Further he opines that follicular ovary occurs in some genera (*Monobothrioides*) but the compact one is not common.

Vagina - The contention of Sawarkar (2012)[1] "vagina open in ootype" is absolutely wrong. Vagina basically has two ends, anteriorly it joins with uterus to make an uterovaginal duct which opens via female gonopore behind the male pore but posteriorly it is connected to oviduct, the latter proceeding posteriorly receives a duct from the vitelline reservoir, its furtherance posteriorly leads into ootype.

Gonopore – How and where the gonopores are situated is on account of an evolutionary event gained through years. A clear picture of association of oviduct, uterus, cirrus sac, ejaculatory duct is shown on page 431 Caryophyllidea (Cestoidea) review of Mackiewicz (1972).

Exceptionally in *Lobulovarium longiovatum* Oros *et al.* (2012) "The male genital pore unites with utero – vaginal duct and opens via single gonopore, common genital atrium being absent – a character against the plan shown by Mackiewicz related to fig.C page. 431 of Mackiewicz, (1972).

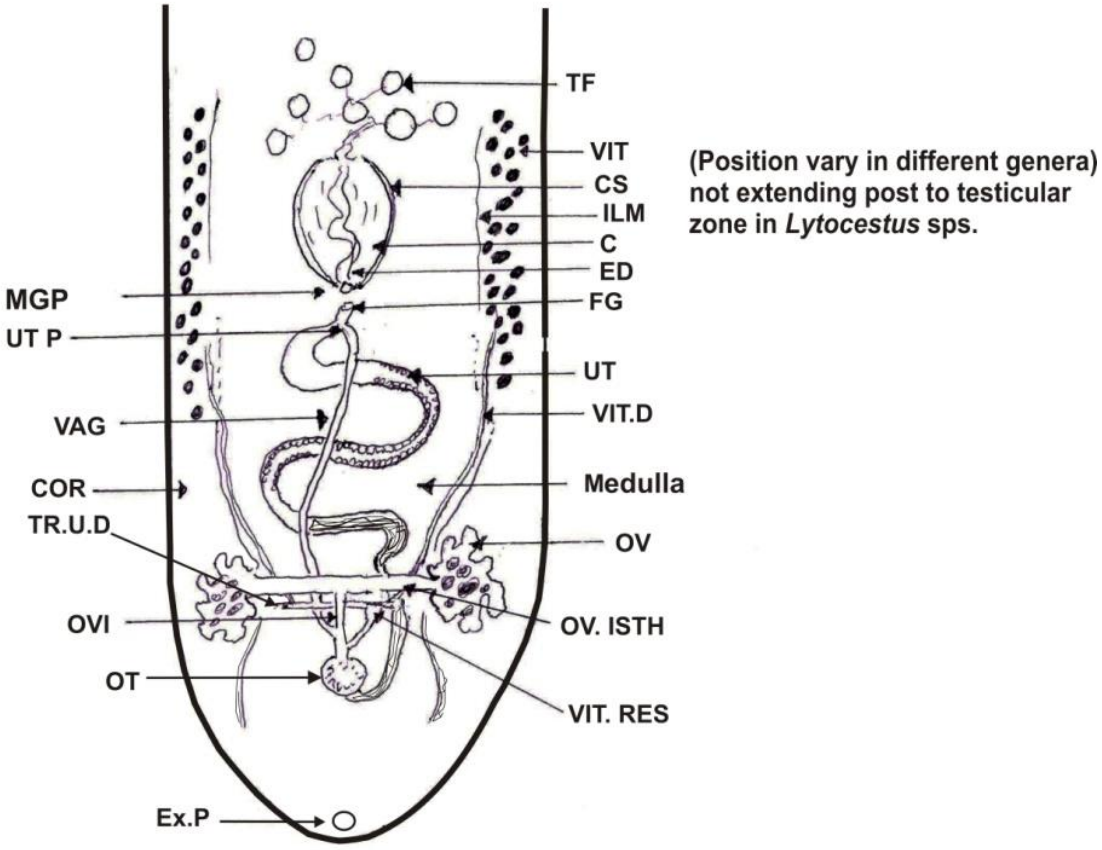

Fig. 1. Diagrammatic representation of post. end of a Caryophyllaeid species showing two ends of vagina, uterogenital duct ut.pore, and separate male & female genital pore etc.

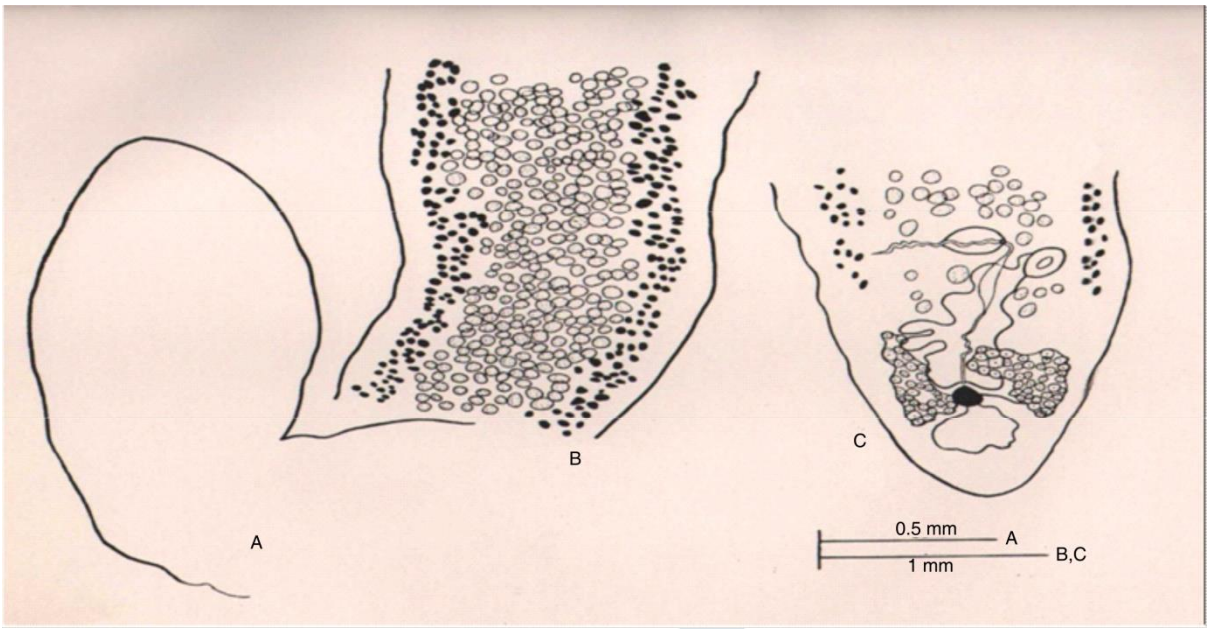

Fig.2. *Lytocestus alii* n.sp. A-Anterior region of the worm, B-Middle region of the worm and C-Posterior region of the worm (all measurements are in micron i.e. µ)
(from original research paper of Sawarkar 2012)

Uterus – Uterine pore, with a thick border obliquely placed does not have systematic value, possibly thickness might be affecting quick release of eggs.

Measuremental differences are always met in cestode species because maturity to adult stage is dependent on various in vivo factors.

Last but not the least the present authors opine that:

There is no need to inflate the taxonomic descriptions of new taxa usually violating the basic rules of International code of nomenclature as has been done in most of the species of *Lytocestus* described from Maharashtra.

The claim of Sawarkar (2012) describing & dealing *Lytocestus alii* (?) to be new is not acceptable to the present authors on the following grounds:

1. *L.alii* was described by Jadhav & Gavahne in the year 1991. With the same name & from the same host, a new species cannot be described as per rules of nomenclature. It is the duplication of epithet *alii*.
2. Ash (2011 a) has already synonimised *L.alii* described by Jadhav & Gavahne (1991) with *L.indicus*. The structural similarity between *L.alii* (?) & *L.indicus* is so strong that, it is better to consider *L.alii* (?) described by Sawarkar (2012) a homonym of *L.alii* Jadhav & Gavahne (1991). Since *L.alli* Jadhav and Gavahne (1991) is a synonym of *L.indicus* vide Ash *et al.* (2011 a). *L.alli* Sawarkar (2012) is also considered a synonym of *L.indicus*.

Comparative chart of *L.indicus* Moghe, 1925 and *L.alii* (?) Sawarkar, 2012.

(all measurements in mms)

Parameters	***L.indicus* Moghe, 1925**			***L.alii* (?) Sawarkar, 2012**	**Comments**
	(a)	**(b)**			
	L.indicus Moghe, (1925)	*L.indicus* Moghe, (1925) Chakravorty & Tondon, (1988)	**Mean**		
Body length	15-29	10.55-19.8	14.50	Long cylindrical 4.805	Variable dependent on age & nutrition. Mean of **b** fits in the range of **a**.
Body breadth at, c. s.level	1.82-2.73	1.45-3.6	2.6	0.674-1.484	2.6 fits in the range of **b**
Scolex length	undifferentiated	1.06-1.98	1.62	Head blunt oval	
Neck length		0.46-1.32	0.74		
Testicular follicles (L x B)	0.119 x 0.002	0.08-0.22 0.04-0.14	0.14 0.09	580-590. preovarian scattered in medullarin 9-11 rows 0.053/0.022-0.121/0.083 in LXB	Range of test. foll. carry no meaning (See text)
Ovarian lobes (L x B)		0.26-0.83 0.99-2.11	0.56 1.65	Rt.lobe with 4-5 rows & Lt.lobe with 8 rows of follicles. Follicles 0.037/0.030 to 0.090/0.030-0.045 (LxB)	Not shown in the diagram
Vitelline follicles (L x B)	0.077-0.088 0.088-0.112	Oval smaller than test. Foll., lateral to testis, pre ovarian arranged in 3-4 rows, 0.07-0.19 0.04-0.12	0.12 0.07		
Pre		1.95-3.66	2.80		

testicular distance					
Pre vit. distance		1.58-3.36	2.32		
Distance between anterior extent of testis and vitellaria		0.19-0.99	0.36		
Position of G.pore from post end	Separate male & female gonopore	1.43-3.63	1.08		
Cirrus sac/ ductus ejaculatorius	With strong mus.wall/ enclosed in compact parenchymatous mass			Oval, transplaced 0.833/ 1.5-0.196 (LxB)	Carries no meaning
Ovary, & vagina, R,	H-shaped bilobed			Bilobed connected by isthumus ov. foll.32-39, Rt.lobe- 4-5 rows , Lt/Lobe -8 rows	not shown in diag.

Measuremental differences are possible because the worms studied fall under different age groups.

This is also true that morphological & molecular approaches are needed to establish the identity. Therefore followings are suggested:

(1) The author should re examine the specimen studied.

(2) Undertake molecular characterisation and chromosomal identification of the worm under question.

(3) Partial sequence of 28S rDNA and chromosomal analysis will be helpful in confirming the species.

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