

# A critical study of the taxonomic status of *Lytocestus mulaansis* Dandawate, (2018)

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## ABSTRACT

Dandawate (2018)<sup>1</sup> reported a new species of the genus *Lytocestus* and named it *Lytocestus mulaansis* under the family *Lytocestidae* (Caryophyllidea) Wardle & McLeod (1952)<sup>2</sup> from a fish *Clarias batrachus* of Mula Dam at Baragaon, Nandur, Taluk Rahauri dist Ahmadnagar M.S. The description of the species appeared in *Aarhat Multidisciplinary International Education Research Journal* vol VII Special Issue XV 2018 on page 37-43.

His paper suffers from a number of mistakes.

The present authors have pointed out the mistakes after critically going through the manuscript and observing the sketch provided and suggested some remedial measures to prove its validity and existence till then the species *Lytocestus mulaansis* is kept under incertae sedis.

**Keywords:** *Lytocestus mulaansis*, review, incertae sedis.

## INTRODUCTION

*Caryophyllidean* cestodes are monozoic cestodes with unique morphology, evolutionary status, genetic stability showing low fecundity yet are extremely successful, their abundance in fishes are on account of “vitelline cells” which can synthesize & store glycogen in the nuclei as a normal function – “a unique phenomena in the animal kingdom.” – Agarwal (1985)<sup>3</sup>

Four families Caryophyllaeidae Leuckart (in Luke, 1910)<sup>4</sup>; *Lytocestidae* Wardle & McLeod (1952)<sup>2</sup>; *Capingentidae* Wardle & McLeod (1952)<sup>2</sup> & *Balanotaeniidae* Mackiewicz & Blair (1978)<sup>5</sup> exist under the order Caryophyllidea.

Under the family *Lytocestidae* Wardle & McLeod (1952)<sup>2</sup> more than fifty species have been reported, mostly from Maharashtra region of India. These are as under :

1. *Lytocestus adhaerens* Cohn (1908)<sup>6</sup>
2. *L. filiformes* Woodland (1923)<sup>7</sup>
3. *L. indicus* Moghe (1925)<sup>8</sup>
4. *L. cunnigtoni* Fuhrmann *et. al* (1925)<sup>9</sup>
5. *L. chalmerisius* Woodland (1926)<sup>10</sup>
6. *L. javanicus* Bovien (1926)<sup>11</sup>
7. *L. birmanicus* Lynsdale (1956)<sup>12</sup>
8. *L. alestes* Lynsdale (1956)<sup>12</sup>

12. *L. lativitellarium* Furtado & Kim Low<sup>16</sup> syn., *Lucknowia microcephala* Bovien (1926)<sup>11</sup> by Ash (2012)<sup>17</sup>

13. *L.fossilis* Singh (1975)<sup>18</sup> Pov- in this sps has been questioned by Tandon *et.al* (2005)<sup>19</sup>
  14. *L.marathawadensis* Shinde & Phad (1988)<sup>20</sup> syn. *Pseudocaryophyllaeus ritai* Gupta & Singh (1983)<sup>21</sup> & by Ash *et.al* (2011a)<sup>22</sup>
  15. *L.alii* Jadhav & Gavahne (1991)<sup>23</sup>
  16. *L.clariasae* Jadhav & Gavahne (1991)<sup>23</sup>
  17. *L.naldurgensis* Kadam, Hiware & Jadhav (1998)<sup>24</sup>
  18. *L.chalisgaonensis* Khalse & Shinde (1999)<sup>25</sup>
  19. *L.kopardaensis* Khalse & Shinde (1999)<sup>25</sup>
  20. *L.teranaensis* Kolpuke, Shinde & Begum (1999)<sup>26</sup>
  21. *L.batrachusae* Pawar & Shinde (2002)<sup>27</sup>
  22. *L.clariasae* (minor) Pawar & Shinde (2002)<sup>27</sup>
  24. *L.vishnupurensis* Shomendra *et.al* (2003)<sup>29</sup>
  25. *L.nagapurensis* Lakhe, Pawar & Shinde (2004)<sup>30</sup>
  26. *L.shindei* Khadap *et.al* (2004)<sup>31</sup>
  27. *L.assamensis* Tandon Chakravarty & Das (2005)<sup>19</sup>
  28. *L.attenuatus* Tandon Chakravarty & Das (2005)<sup>19</sup> syn. of *Bovienia indica* Niyogi *et.al* (1982)<sup>32</sup> by Ash (2012)<sup>17</sup>
  29. *L.clariae* Tandon Chakravarty & Das (2005)<sup>19</sup> syn. of *Bovienia indica* Niyogi *et.al* (1982)<sup>32</sup> by Ash (2012)<sup>17</sup>
  30. *L.heteropneusti* Tandon Chakravarty & Das (2005)<sup>19</sup> syn. Of *Lucknowia fossilisi* by Ash (2012)<sup>17</sup> Sahay, Mandal, Saxena & Singh (2017)<sup>33</sup> held this species valid under *Lytocestus*.
  31. *L.bokaroensis* Poonam (2007)<sup>34</sup>
  32. *L.majumdari* Poonam (2007)<sup>34</sup>
  33. *L.paithanensis* Shelke (2007)<sup>35</sup> Sahay, Khalkho, Ekka & Mandal (2019)<sup>36</sup> held this species invalid
  34. *L.jagtai* Tripathi *et.al* (2007)<sup>37</sup>
  35. *L.punensis* Jadhav, Bhure & Padwal (2008)<sup>38</sup>
  36. *L.subhapradhi* Jawlikar, Pawar & Shinde (2008)<sup>39</sup>
  37. *L.moghei* Sharma (2009)<sup>40</sup>
  38. *L.murhari* Kaul & Suryavanshi (2010)<sup>41</sup>
  39. *L.folliculariae* Bhure *et.al* (2010)<sup>42</sup>
  40. *L.osamabadensis* Bhure *et.al* (2010)<sup>42</sup>
  41. *L.shindei* Suryavanshi *et.al* (2010)<sup>43</sup>
  42. *L.vayasaei* Pawar & Hiware (2011)<sup>44</sup>
  43. *L.purnensis* Pawar & Hiware (2011)<sup>44</sup>
  44. *L.geriapinusae* Kadam *et.al* (2011)<sup>45</sup>
  45. *L.khami* Jawle *et.al* (2011)<sup>46</sup>
  46. *L.thapari* Sawarkar (2012)<sup>47</sup>
  47. *L. alii* (minor) Sawarkar (2012)<sup>47</sup>
  48. *L.manjarensis* Solunki *et.al* (2012)<sup>48</sup>
  49. *L.rekhaensis* Nimbalkar *et.al* (2012)<sup>49</sup> Sahay, Khalkho (2017)<sup>50</sup> kept this species under enquiry.
  50. *L.indica* Deshmukh (2015)<sup>51</sup> was kept under incertae sedis by Sahay, Singh & Saxena (2018)<sup>52</sup>
  51. *L.mastacembellusi* Pardeshi (2016)<sup>53</sup>. Sahay, Khalkho, Singh & Mandal (2019)<sup>54</sup> kept the species under “incertae sedis”.
  52. *L.mulaansis* Dandawate (2018)<sup>1</sup>
  53. *L.bharatae* Patil (2018)<sup>55</sup>
- [Serial:18,23,25,26,33,35,45,48]

These were reported to have granular vitellaria. Ash (2012)<sup>17</sup> synonymised these with *L.indicus* Moghe (1725)<sup>8</sup> but got resurrected by Sahay, Singh, Kamal & Jha (2018)<sup>56</sup> – *Ref.J.Exp.Zool.india* **21(2)** :1271-1276.

■ [Serial:9,10,11,31,32] were considered Syn. Of *Pseudocaryophyllaeus tenuicollis* Bovien (1926)<sup>11</sup> by Ash (2012)<sup>17</sup>

● [Serial:13,34]

*L.jagtai* Tripathi (2007)<sup>37</sup> was considered synonym of *Lucknowia fossilisi* Gupta (1961)<sup>57</sup> by Ash *et.al* (2011b)<sup>58</sup>. Later Sahay & Ekka (2019)<sup>59</sup> considered both *L.jagtai* Tripathi (2007)<sup>37</sup>

& *Lucknowia fossilisi* Singh (1975)<sup>18</sup> Synonym of *Lucknowia fossilisi* Gupta (1961)<sup>57</sup> after giving full length discussion which appeared in *Trends of Fisheries research* **8(2)** on pp.78-85.

■ [Serial:24] was considered synonym of *Lytocestus.indicus* Moghe (1725)<sup>8</sup> by Singh, Sahay & Sadaf (2018)<sup>60</sup> - *Ref.J.Exp.Zool.India.* **21(2)** : 893-896.

◆ [Serial:15,16,17,19,20,21,22,36 & 38]

*Lytocestus [alii* Jadhav *et.al* (1991)<sup>23</sup>; *clariasae* Jadhav *et.al* (1991)<sup>23</sup>; *naldurgensis* Kadam *et.al* (1998)<sup>24</sup>; *kopardaensis* Khalse *et.al* (1999)<sup>25</sup>; *teranaensis* Kolpuke *et.al* (1999)<sup>26</sup>; *batrachusae* Pawar *et.al* (2002)<sup>27</sup>, *clariasae* (minor) Pawar *et.al* (2002)<sup>27</sup>; *subhapradhi* Jawlikar *et.al* (2008)<sup>39</sup>; *murhari* Kaul *et.al* (2010)<sup>41</sup>], were considered synonym of *L.indicus* Moghe (1925)<sup>8</sup> by Ash (2012)<sup>17</sup>.

## Observation and Discussion:

The main characteristics of *Lytocestus mulaansis* Dandawate (2018) are as under:

“Length – 24.20 - 24.23 x 2.90 – 3.20; Head long well marked off from body 4.385 – 4.847 (4.116) x 0.727 – 2.270 (1.998); number of testicular follicles 390 – 450 (470) pre ovarian, evenly distributed, follicle being 0.121 – 0.182 (0.51) x 0.091 – 0.114 (0.103); CP. Small pre ovarian, transversely placed 0.114-0.193 (0.125) x 0.025 – 0.033 (0.029); vagina – long coiled starts from genital pore runs posteriorly 0.080 – 0.099 (0.090) x 0.005 – 0.020 (0.015);

ootype median oval between ovarian lobes 0.114 – 0.168 (0.0143) x 0.098 – 0.146 (0.125),

ovary bilobed in posterior region each lobe measures 0.225 – 0.477 (0.352) x 0.270 – 0.460

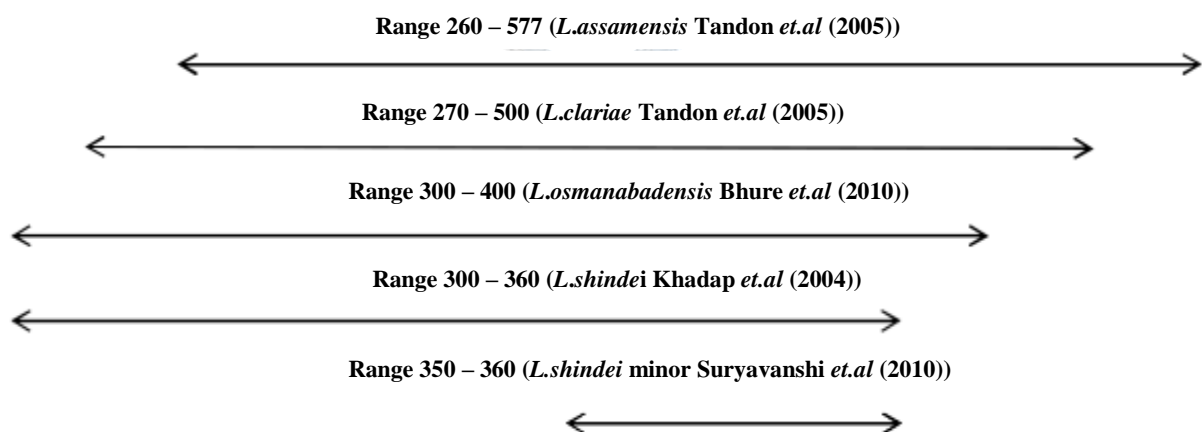
(0.365) each lobe with 25-26 ovarian ovarian follicles, lobes connected by isthmus 0.047-0.082 (0.66) x 0.270 – 0.460 (0.365), uterus wide convoluted filled with eggs, open separately outside body by uterine pore length being 0.159 – 0.174 (0.167) x 0.024 – 0.045 (0.035), eggs operculated 0.172 – 0.19 (0.181) x 0.210 – 0.231 (0.221) vitelline follicles granular”

**Lacunae (mistakes):**

- I. In the text a number of names of the authors who described species in past have been mentioned such as Cohn (1980); Woodland (1923,1924); Fuhrman and Baer (1925); Moghe (1925); Mehra (1930); Ramadevi (1973); Wardle & McLeod (1952); Wardle & McLeod & Radinovsky (1974); Mackiewicz (1942 & 1972); Bovien (1926); Furtado (1963); Lynsdale (1950, 1956); Ramadevi (1973); Hiware & Jadhav (1991); Kolpuke & Shinde (1999); Patil & Yadav (2002); Shinde & Pawar (2002,2004); Khadap, Jadhav & Suryavanshi (2004); Tandon *et.al* (2005) but these do not appear in the references mentioned rather in reference irrelevant references have been quoted.
- II. The number of testicular follicles in the species under discussion has been mentioned to be (390 - 450), mean value being 470. The range clearly indicates that worms studied were not of the same age. For all most all species described the testicular follicle range, has been given in past but giving cognisance to this parameter has already been negated by Sahay, Khalkho, Singh & Mandal (2019)<sup>61</sup>. Sahay *et.al* (2019)<sup>54</sup> nullified the key to the species of *Lytocestus* proposed by Jadhav, Bhure & Padwal (2008)<sup>48</sup>; Solunke, Fadke, Borde & Jawle (2012)<sup>48</sup>; Jawle & Borde (2011)<sup>46</sup> based on the number of testicular follicles giving substantial arguments.

Sahay *et.al* (2019)<sup>54</sup> argued & opined that “Species identification based on the number of testicular follicles is questionable because, the range depicts that the worms in question were not of the same age and that the worms were more than one. If the worms are of the same age the number of testicular follicles should be more or less constant for a species”.

Let us examine:



The range 270 – 500 of *L.clariae*; 300 – 400 of *L. osmanabadensis*; range 300 – 600 of *L.shindei* & the range 350 – 360 of *L.shindei* Suryavanshi (2010) all falls in the range of 260 – 577 of *L.assamensis*.

If one gets specimens showing a range of 265 – 299 where the investigator will keep amongst the aforesaid species?

Similarly in the range of testicular follicles of *L. nagapurensis* Lakhe *et.al* (2004)<sup>25</sup> 1000-1200 fall in the range 1000-1100 of *L.indica* Deshmukh (2015)<sup>51</sup> & 1000-1200 of *L.puranesis* Kasar *et.al* 2010.

Therefore, the authenticity of the range of testicular follicles cannot be given cognisance while identifying the species. A list of species with their number of testicular follicles is annexed ahead.

3) Prior to 2018, quite a good number of species were described (vide serial 1-51), what forced the author of *L.mulaansis* to compare his specimens only with only 20 species? viz.,

*L(indicus, filiformis, alestesi, birmanicus, longicollis, fossilis, marathawadensis,alii, clariasae, naldurgensis, teranaensis,caryophyllid* Patil & Yadav (2002), *batrachusae, shindei* Khadap *et.al, nagapurensis, clariae, attenuatus, assamensis, heteropneustii*)

[Serial no- 3,2,8,7,11,13,17,15,16,17,20, ?, 21,26,25,29,28,27,30 ]= total 19 species

? It is evident therefore, that he had no access to description of other species.

4) Cirrus pouch – In the diagram provided by the author of *L. mulaansis* Cirrus pouch has been shown in the right side almost near body wall where as in text he mentions as following:

“The cirrus pouch is small, preovarian transversely placed & measures 0.125 (0.114-0.133) x 0.029 (0.025 -0.33) in length & breadth. This seems to be fixational defect as it is generally in the medullary parenchyma anterior to uterovaginal pore.

5) Vitelline follicles – The author of *L.mulaansis* observed it to be granular. It is a sign of immaturity. He could have observed the follicles under high resolution of the microscope to ascertain if these possess glycogen in the nuclei- “a phenomena unique to animal kingdom” Agarwal(1985). Glycogen is heavier then lipid and can be utilised under anerobic condition consistent with the life cycle that has benthic intermediate hosts Mackiewicz (1981a).

Even Mackiewicz (1981) opines that “ Ultra structural characters of vitellocytes in the Caryophyllidea as exemplified by the mass glycogen in the nucleus,for example, are closely related to the nature of their life history.

Sahay (2007) opines that higher level of glycogen in caryophyllaeids is indicative of lower caloric value than lipid which are the result of lower oxygen concentration in the enteric environment but low fecundity & relative abundance is due to K. selection strategies as an environmental condition.

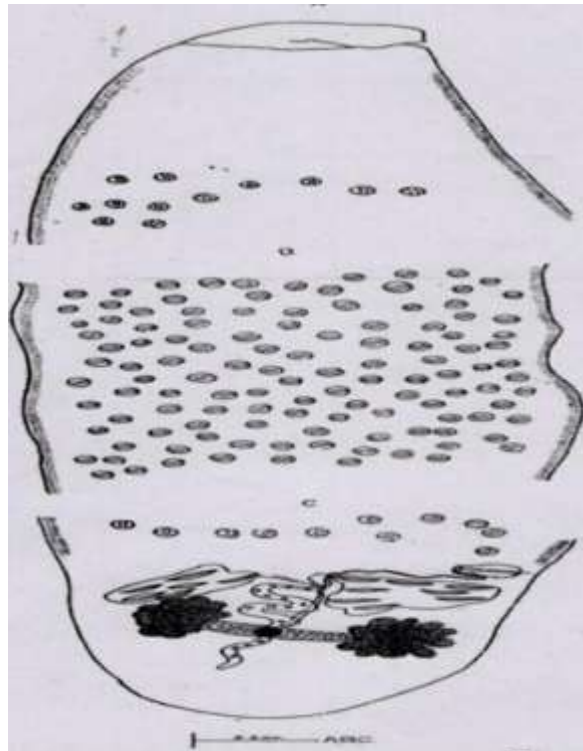
The author also failed to mention about the vitelline ducts as to how these open posteriorly to meet the ootype.

Normally two longitudinal vitelline duct descnds from anterior region, gives two transverse vitelline ducts in the vicinity of isthmus medially which unite to form a vitelline reservoir (may or may not be present) which continues further behind as vitelloduct and connects the vitelline gland system with oviduct.

6) Vagina – The author of *L. mulaansis* further says, “ Vagina is a long coiled tube, starts from genital pore & runs posterior in the body”. whether it joins with uterus anteriorly behind

cirrus sac has not been mentioned neither where it joins posteriorly has not been mentioned. The author also failed to provide photomicrograph, transverse section of body which would have provided him a clue to its right placement.

On the above stated grounds the existence of *L.mulaansis* becomes doubtful unless the observation made are revised. It is suggested that the author should undertake electrophoretic study of the protein profiles or go for molecular characterisation, caryotypic study etc to substantiate that specimens are new species till then the said species is kept under “incertae sedis”.



**Fig - *L.mulaansis*** Dandawate (2018) – from his research paper

List of species of *Lytocestus* with the range of testicular follicles as reported by their authors:-

Species	Author	Range (No. of testicular follicles)	Comments
<i>Lytocestus longicollis</i>	Ramadevi (1975) <sup>15</sup>	100 – 105	100 – 104 according to Yadav <i>et.al</i> (2008)
<i>L.birmanicus</i>	Lynsdale (1956) <sup>12</sup>	170-384	
<i>L.attenuatus</i>	Tandon <i>et.al</i> (1956) <sup>19</sup>	190 - 400	155-398 (?)
<i>L.indicus</i>	Moghe (1925) <sup>8</sup>	230 - 270	
<i>L.heteropneusti</i>	Tandon <i>et.al</i> (1956) <sup>19</sup>	230 - 340	235 – 340 according to Yadav <i>et.al</i> (2008)
<i>L.assamensis</i>	Tandon <i>et.al</i> (1956) <sup>19</sup>	260 – 577	266 – 565 according to Yadav <i>et.al</i> (2008)
<i>L.clariae</i>	Tandon <i>et.al</i> (1956) <sup>19</sup>	270 - 500	270 – 495 according

			to Yadav <i>et.al</i> (2008)
<i>L.osmanabadensis</i>	Bhure <i>et.al</i> (2010) <sup>40</sup>	300 - 400	Or 300 – 350
<i>L.shindei</i>	Khadap <i>et.al</i> (2004) <sup>26</sup>	300 -360	350 -360 wide Yadav <i>et.al</i> (2008)
<i>L.rekhaensis</i>	Nimbalkar <i>et.al</i> (2012) <sup>49</sup>	310 - 330	
<i>L.shindei (minor)</i>	Yadav & Suryavanshi <i>et.al</i> (1979)	350 – 360	wide Yadav <i>et.al</i> (2008)
<i>L.godavarensis</i>	Dandawate Lonkar (2016) <sup>1</sup>	400- 500	
<i>L.follicularae</i>	Bhure <i>et.al</i> (2010) <sup>39</sup>	400 – 500	
<i>L.niraensis</i>	?	425 - 500	
<i>L.manjarensis</i>	Solunke <i>et.al</i> (2012) <sup>48</sup>	460 - 467	
<i>L.alii</i>	Jadhav <i>et.al</i> (1991) <sup>47</sup>	460 - 480	
<i>L.naldurgensis</i>	Kadam <i>et.al</i> (1988) <sup>17</sup>	500 - 600	
<i>L.alii</i>	Sawarkar (2012) <sup>47</sup>	580 - 590	
<i>L.murhari</i>	Kaul <i>et.al</i> (2010) <sup>38</sup>	600 – 700	Two reports
<i>L.clariasae</i>	Yadhav & Ghavne (1991) <sup>23</sup>	700 - 750	Two reports
<i>L.clariasae</i>	Yadav <i>et.al</i> (1991) <sup>23</sup>	700 - 800	700 – 750 according to Yadav <i>et.al</i> (2008)
<i>L.indica</i>	Deshmukh (2015) <sup>51</sup>	1000 - 1100	
<i>L.nagapurensis</i>	Lakhe <i>et.al</i> (2004) <sup>25</sup>	1000 - 1200	1100 – 1150 according to Yadav <i>et.al</i> (2008)
<i>L.puranensis</i>	Kasar, Bhure, Nanware and Sonue (2010) <sup>7</sup>	1000 - 1200	
<i>L.teranaensis</i>	Kolpuke (1999) <sup>20</sup>	1200 - 1500	
<i>L.khami</i>	Jawle <i>et.al</i> (2011) <sup>46</sup>	1350 - 1400	
<i>L.punensis</i>	Jadhav <i>et.al</i> (2008) <sup>55</sup>	1400 - 1500	1450-1500 according to Yadav <i>et.al</i> (2008)
<i>L. govindae</i>	Patil <i>et.al</i> (2002) <sup>23</sup>	1425 - 1475	
<i>L. chalisgaonensis</i>	Khalse <i>et.al</i> (1999) <sup>18</sup>	1500-1600	
<i>L.paithanensis</i>	Shelke (2007) <sup>55</sup>	1550 – 1575 (1565)	
<i>L.shindei</i>	Suryavanshi <i>et.al</i> (2010) <sup>41</sup>	1570 - 1590	
<i>L.kopardaensis</i>	Shinde & Borde (1999) <sup>19</sup>	1600 - 1700	
<i>L.batrachusae</i>	Pawar & Shinde (2002) <sup>21</sup>	3800 – 4000	
<i>L.clariasae</i>	Pawar & Shinde (2002) <sup>21</sup>	5800 - 6000	
<i>L.mastacembellusi</i>	Pardeshi (2016) <sup>53</sup>	6000 - 6200	
<i>L.mulaansis</i>	Dandawante (2018) <sup>1</sup>	390 – 450 (M = 470)	

- ◆ The authors of *Lytocestus* sps. from Maharashtra “mistook median vitelline follicles as testes” & thus the numbers of testes reported is apparently erroneous – Ash *et.al* (2011)
- ▲ Syn. Of *Lucknowia fossilisi* Gupta (1961) – according to Ash (2011)
- Pawar and Shinde (2002) ignored the existance of same species (*L.clariasae*) by Jadhav & Ghavne (1991) hence his sps. is a homonym of Jadhav & Ghavne sps.
- ◆ *L.birmanicus* Lynsdale (1956); *L.parvulus* Furtado (1963); *L.moghei* Murhar (1963); *L.longicollis* Ramadevi(1973); *L.majumdari* Poonam (2007) were considered synonym of *Pseudocaryophyllaeus tenuicollis* Bovien (1926) by Ash *et.al* (2011a)

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