

Research Article

IDENTITY OF *GUDUSIA CHAPRA* AND RE-ESTABLISHMENT OF *GUDUSIA SUHIA* (FAMILY CLUPEIDAE: CLUPEIFORMES)

M. Arunachalam^{1*}, Agnes Flora¹, S. Chinnaraja² and Asha Rayamajhi¹,

¹Manonmaniam Sundaranar University, Sri Paramakalyani Centre for Environmental Sciences, Alwarkurichi-627 412, Tamil Nadu, India

²Research Department of Zoology, Poompuhar College (Autonomous), Melaiyur-609 107, Nagappattinam District, Tamil Nadu, India

Article History: Received 18th August 2015; Accepted 18th October 2015; Published 29th October 2015

ABSTRACT

In the genus *Gudusia*, *G. godanahiae* and *G. suhia* are synonymised with *G. chapra*. Based on recent collections from India and Nepal we established the identity of *Gudusia suhia* and it can be distinguished from *G. chapra* in having fewer anal fin rays (22 vs. 24-26) and fewer lateral transverse scale rows (26 vs. 31-35).

Keywords: Clupeidae, Identity, *Gudusia chapra*, Re-establishment, *G. suhia*.

INTRODUCTION

Genus *Gudusia* is represented by three species, *Gudusia chapra* (Hamilton), *G. godanahiae* (Srivastava 1968) and *G. vareigata* (Day 1889). However, *G. godanahiae* was synonymized with *G. chapra* by later workers and also another species, *G. suhia* (Chaudhuri 1912) is also under synonymy with *G. chapra*. Recently we collected specimens of *Gadusia* from the rivers in Uttar Pradesh, India and from Nepal, which on closer examination show that there are two distinct species namely, *G. chapra* and *G. suhia* and hence we herein redescribe *Gadusia chapra* and resurrect *G. suhia* from synonymy of *G. chapra*. Also *G. godanahiae* is synonymized with *G. chapra*.

MATERIALS AND METHODS

Fish collections were made during 2010-12 by Dr. M. Arunachalam and Dr. C. Vijayakumar from fishermen near rivers and lakes and also from fish markets in U.P., India. Fish sampling (*Gudusia chapra*) was also carried out in Koshi River at Koshi Barrage, eastern Nepal in April, 2014. Methods used for the meristic and morphometric data are based on Hubbs and Lagler (1964). Morphometric characters from 9, 18-26 and 29-31 and 34-35 are the

additional truss measurements (Strauss and Bookstein 1982). Additionally we provide one meristic character of L.tr. (Day 1889) as “number of longitudinal rows of scales between the back and abdomen, usually counted, unless some other part of the side is specified, from the anterior end of the dorsal fin to the ventral”. Body measurements are expressed as percentage of Standard Length (%SL); head measurements are expressed as percentage of Head Length (%HL). Materials examined in this study are deposited in Fisheries Research Division Fish Museum, Kathmandu, Nepal (FRDFM). Comparison materials are from MSUMNH (Manonmaniam Sundaranar University, Museum of Natural History) and also from CMA (collections of M. Arunachalam).

RESULTS

***Gudusia chapra* (Hamilton)**

(Figures 1A-1B and Tables 1-2)

Diagnosis: *Gudusia chapra* is distinguished with its congener *Gudusia suhia* in having more anal fin rays (24-26 vs. 22), more pectoral fin rays (12-14 vs. 11), more lateral transverse scale rows (31-35 vs. 26), more

*Corresponding author e-mail: arunacm@gmail.com

circumferential scale rows (61-71 vs. 59-60), greater distance of dorsal insertion to anal origin (24.46-28.0 vs. 22.50-22.62 %SL), lesser dorsal fin base length (12.28-13.48 vs. 14.78-16.75 %SL), greater distance of pelvic fin and vent (18.75-21.91 vs. 17.79-17.97 %SL) and less deeper head at pupil (46.18-55.39 vs. 56.88-57.14 %HL).

Table 1. Meristic characters of *Gudusia chapra* and *Gudusia suhia*.

Meristic characters	<i>Gudusia chapra</i>	<i>Gudusia suhia</i>
	MSUMNH 131, 197. CMA 74, 176, 179, CAR 3, n=13	CMA 178, n=2
1. Dorsal fin rays	15-17	16
2. Anal fin rays	24-26	22
3. Pelvic fin rays	9-11	9-10
4. Pectoral fin rays	12-14	11
5. Caudal fin rays	10+9	10+9
6. L.tr. (Day)	31-35	26
7. Lateral longitudinal scale rows	80-90	78-80
8. Pre-dorsal scales	22-26	26
9. Pre-pelvic scutes	18-19	19-20
10. Post-pelvic scutes	9-10	9
11. Circumpeduncular scales	26-29	26-28
12. Circumferential scales	61-71	59-60
13. Transverse breast rows	6-8	7-8
14. Anal scale rows	3-4	3

Table 2. Morphometric characters of *Gudusia chapra* and *Gudusia suhia*.

Body characters in % Standard Length, Head characters in % Head Length	<i>Gudusia chapra</i> MSUMNH 131, 197 CMA 74, 176, 179, CAR 3, n=13	<i>Gudusia suhia</i> CMA 178 n=2
1. Standard length	72.33-101.57	92.42-97.48
% of standard length		
2. Snout to urocentrum	90.48-97.87	94.54-95.34
3. Pre anal length	65.77-71.71	64.03-68.21
4. Pre dorsal length	43.34-48.47	43.67-47.40
5. Pre pelvic length	46.75-51.84	47.46-49.87
6. Pre pectoral length	25.62-29.51	26.75-27.71
7. Pre occipital length	19.38-21.94	20.21-21.50
8. Caudal peduncle length	6.35-8.92	6.77-6.89
9. Dorsal origin to pelvic insertion	27.93-35.51	28.86-29.36
10. Dorsal spinous height	15.22-20.37	17.68-19.06
11. Anal fin height	5.64-9.44	5.78-8.15
12. Depth of caudal peduncle	8.96-11.48	9.84-9.92
13. Caudal fin length	24.40-33.23	26.25-31.04
14. Dorsal fin height	15.69-22.74	19.56-20.32
15. Pectoral fin length	16.50-19.52	16.81-17.00
16. Pelvic fin length	8.91-12.12	9.69-11.15
17. Pelvic auxiliary scale length	2.27-4.22	2.39-2.92
18. Occiput to dorsal fin origin	24.64-27.86	24.76-28.21
19. Occiput to pectoral fin insertion	23.38-26.55	23.97-24.83
20. Occiput to pelvic fin insertion	38.98-41.75	37.56-39.08
21. Dorsal insertion to pelvic fin insertion	24.73-34.23	26.30-27.64

22. Dorsal origin to pectoral fin insertion	29.74-35.77	30.77-32.76
23. Dorsal origin to anal fin origin	32.77-38.32	32.46-33.10
24. Dorsal fin insertion to caudal	33.35-41.65	35.88-39.15
25. Dorsal insertion to anal fin origin	24.46-28.01	22.50-22.62
26. Dorsal insertion to anal fin insertion	31.11-37.28	32.06-32.90
27. Dorsal fin base length	12.28-13.48	14.78-16.79
28. Anal fin base length	18.11-22.15	20.61-21.62
29. Pectoral insertion to pelvic insertion	19.19-22.74	19.96-22.13
30. Pectoral insertion/to anal fin origin	37.58-40.77	36.33-39.19
31. Pelvic insertion to anal fin origin	17.39-19.48	15.08-17.73
32. Post-dorsal length	46.49-56.01	54.59-56.29
33. Body depth	29.97-37.09	29.96-30.46
34. Distance b/w pectoral fin to vent	39.62-43.58	38.49-38.76
35. Distance b/w pelvic fin to vent	18.75-21.91	17.79-17.97
36. Head length	27.61-33.40	29.18-29.22
% of head length		
37. Snout to opercle	62.09-71.50	66.04-70.26
38. Snout length	18.12-24.60	18.33-21.62
39.Upper jaw length	19.41-27.26	23.00-24.03
40. Pre nasal length	7.86-11.47	8.60-10.05
41. Orbit width	24.15-29.21	26.47-28.02
42. Inter orbital width	21.20-27.32	22.40-22.43
43. Inter nasal width	9.63-15.63	11.90-13.13
44. Head width	26.31-39.30	32.76-34.37
45. Gape width	11.11-17.33	15.98-16.83
46. Lower jaw to isthmus	65.10-70.43	63.44-67.42
47. Head depth at nostril	22.10-32.67	24.88-25.32
48. Head depth at pupil	46.18-55.39	56.88-57.14
49. Head depth at occiput	73.36-84.62	84.06-86.10
50. Maxillary bone	22.52-31.24	28.44-29.39

Gudusia chapra is distinguished from *Gudusia variegata* (Day, 1889) in having fewer number of pectoral fin rays (12-14 vs. 17), more pelvic fin rays (9-11 vs. 8) and greater number of caudal fin rays (19 vs. 17). *Gudusia chapra* can be differentiated from *Gudusia variegata* in the absence of bars across the body (vs. a row of about 18 bars passes across the back and descends a short way over the sides).

Description: Counts and measurements are from thirteen specimens from 72.33-101.57 mm SL.

Body short, oblong and compressed. Dorsal profile convex from tip of snout to dorsal-fin origin. Dorsal profile from dorsal fin origin to caudal-fin base is not straight; its depth gradually decreases from dorsal fin origin towards caudal fin base. Ventral profile of body from snout tip to pelvic-fin origin is convex than the posterior of pelvic-fin origin towards the base of caudal fin. Abdomen profile more convex than dorsal profile with single row of scutes along ventral midline from the branchiostegal rays before anus. Body depth at dorsal origin is 29.97-37.09 % SL.

Head scaleless; head length is 27.61-33.40 %SL. Head depth at nostril, orbit and occiput 22.10-32.67, 46.18-55.39

and 73.36-84.62 %HL respectively. Eyes are situated in dorsolateral position above middle region of head and visible from ventral region. Eyes with a broad adipose eyelid and width of orbit 24.15-29.21 %HL; inter orbital width is broader than nostril width, its width 21.20-27.32 %HL while nostril width is 9.63-15.63 %HL. Mouth is somewhat blunt. Both jaws are almost similar in length, upper jaw having a notch at the symphysis where lower lip is fitted on that notch. Snout length 18.12-24.60 %HL. Gape width 11.11-17.33 %HL. Teeth absent. Margin of upper jaw formed by straight maxillaries reaching almost middle or up to middle below orbit. Barbels are absent.

Fin counts are: dorsal-fin rays, iv-12(7), iii-13(4), iv-13(2); pectoral fin rays, i-12(10), i-11(2), i-13(1), pelvic fin rays, ii-8(7), i-9(3), i-8(1), ii-9(2); anal fin rays, iii-21(1), iii-22(7), iii-23(5); caudal fin rays, 10-9(13).

Fins are devoid of spines. Dorsal fin length is 15.69-22.74 %SL. Origin of the dorsal fin is anterior to that of pelvic fin. Pre-dorsal length is lesser (43.34-48.47 %SL) than pre pelvic length (46.75-51.84 %SL) and this showed the position of the dorsal fin being anterior to vertically

pelvic fin. Pectoral fins are placed low and are not reaching the pelvic and are separated from pelvic fin origin by a distance of 3 scales. Pectoral fin is longer than the pelvic fin, its length 16.50-19.52 %SL. Pelvic fins are in the middle of the abdomen. Length of the pelvic fin is 8.91-12.12 %SL. Peduncle length 6.35-8.92 %SL and depth of peduncle 8.96-11.48 %SL. Dorsal fin base is less wider than the anal fin base length. Length of dorsal fin base is 12.28-13.48 %SL and length of anal fin base 18.11-22.15 % SL. Anal fin length is 5.64-9.44 %SL and anal fin is not reaching the base of caudal fin. Caudal fin deeply forked, lower lobe is slightly longer than upper and its length is 24.40-33.23 %SL. Post dorsal length 46.49-56.0 %SL. Distance between pectoral fin and vent is 39.62-43.58 %SL whereas distance between pelvic fin to vent 18.75-21.91 %SL.

Scales cycloid, smooth and are placed in horizontal rows but over the abdomen closely set. A row of pre-dorsal

scales, 22(7), 23(4), 24(1), 26(1), lateral-line scales at longitudinal row, 80(5), 81(1), 85(2), 86(1), 89(2), 90(2); lateral transverse rows (L.tr.), 31(3), 32(6), 33(2), 35(2); circumpeduncular scale rows, 26(2), 27(2), 29(9); circumferential scales 61(7), 69(3), 70(1), 71(2), transverse breast rows scales, 6(1), 7(4), 8(8); anal scale rows, 3(7), 4(6). Pre pelvic scutes from isthmus to pelvic fin origin 18(12), 19(1), post pelvic scutes from after pelvic fin origin to anus 9(7), 10(6).

Coloration: Body is silvery white in live specimens and after preservation in 10% formalin or absolute alcohol the color changes to brown along the dorsum of the body. Laterally 6-9 black blotches above middle of lateral body and these blotches are from the commencement of operculum to caudal fin base towards dorsal side but one specimen have no black dot on dorsal side of body, black margin at outer margin of caudal fin.



Figure 1A. *Guusia chapra* : MSUMNH 131. 1ex, 101.57 mm SL, Sarayu River U.P. collected by M. Arunachalam and team, 06 May 2010.



Figure 1B. *Gudusia chapra*: CMA 176. 1ex, 83.82 mm SL, Paniyohoya, Gandok nagar, Kusinnagar (Dt), U.P. collected by M. Arunachalam and team, 04 March 2013.

Gudusia suhia (Chaudhuri 1912)

(Figure 2A and Tables 1-2)

Description: Counts and measurements are from two specimens from 92.42-97.48 mm SL. Body oblong and

compressed. Dorsal profile less convex than abdominal profile; dorsal profile depth gradually decreases from dorsal fin origin towards caudal fin base. Ventral profile of body from snout tip to origin of pelvic-fin is convex than posterior of pelvic-fin origin towards base of caudal fin.

Abdomen profile having a single row of scutes along ventral midline from the branchiostegal rays before anus. Body depth at dorsal origin is 29.96-30.46 %SL. Head without scales; head length is 29.18-29.22 %SL. Head depth at nostril 24.88-25.32%HL, at orbit 56.88-57.14 %HL and at occiput 84.06-86.10 %HL respectively. Eyes are above middle region of head on dorsolateral position and visible from ventral side. Eyes having broad adipose eyelid. Orbit width is 26.47-28.02 %HL. Interorbital width is broader than nostril width, its width 22.40-22.43 %HL while nostril width is 11.90-13.13 %HL. Mouth is blunt. Both jaws are almost similar in length, upper jaw having a notch at the symphysis where lower lip is fitted on that notch. Snout length 18.12-24.60 %HL. Gape width 15.98-16.83 %HL. Teeth absent. Margin of upper jaw formed by straight maxillaries reaching almost middle of orbit below. Barbels are absent.

Fin counts are: dorsal-fin rays iv-12(2); pectoral fin rays i-10(2); pelvic fin rays ii-7(1)-8(1); anal fin rays ii-20(2) and caudal fin rays 10-9(2).

Fins are devoid of spine. Dorsal fin length is 19.56-20.32 %SL. Origin of the dorsal fin is anterior to the pelvic fin. Pre-dorsal length is lesser (43.67-47.40 %SL) than pre pelvic length (47.46-49.87%SL) and this showed the position of the dorsal fin being anterior to the pelvic fin. Pectoral fins are placed low and not reaching the pelvic fin, and separated from pelvic fin origin by a distance of 2 scales. Pectoral fin is longer than the pelvic fin, its length 16.81-17.00 %SL. Pelvic fins are in the middle of the abdomen. Length of the pelvic fin is 9.69-11.15 %SL.

Caudal peduncle length is shorter than its depth. Length and depth of caudal peduncle are 6.77-6.89 %SL and 9.84-9.92 %SL respectively. Length of dorsal fin base is less wide than the anal fin base. Length of dorsal fin base is 14.78-16.75 %SL and length of anal fin base 20.61-21.62 % SL. Length of anal fin is 5.78-8.16 %SL and not reaching the base of caudal fin. Caudal fin deeply forked, lower lobe is slightly longer than upper lobe and its length is 26.25-31.04 %SL. Post dorsal length is 54.59-56.29 %SL. Distance between pectoral fin and vent is 38.49-38.76 %SL whereas distance between pelvic fin and vent is 17.79-17.97 %SL.

Scales cycloid, smooth and placed in horizontal rows but over the abdomen closely set. A row of pre-dorsal scales 26(2); lateral-line scales at longitudinal row 78(1), 80(1); lateral transverse rows (L.tr.) 26(2); circumpeduncular scale rows 26(1), 28(1); circumferential scales 59(1)-60 (1); transverse breast row scales 7(1)-8(1); anal scale rows 3(2). Pre pelvic scutes from isthmus to pelvic fin origin 19(1)-20(1); post pelvic scutes after pelvic fin origin to anus 9(2).

Coloration: In live specimens, body is silvery white and after preservation in 10% formalin or absolute alcohol, the color changes to dark brown along the dorsum of the body and towards abdomen, the body color is comparatively lighter brown. Laterally 7 - 8 black blotches above middle of lateral body and these blotches are from the commencement of operculum to caudal fin base towards dorsal side.



Figure 2A. *Gudusia suhia*: CMA 178. 1ex, 97.48 mm SL, Ganges River, Vijaya nager (market collection), Kanpur. collected by M. Arunachalam and team, 11 July 2011.

DISCUSSION

Origin of dorsal fin is anterior to pelvic fin in *Gudusia chapra* by previous authors including (Day 1878). He mentioned that the origin of the dorsal fin is opposite or slightly before pelvic and Whitehead (1965) stated that pelvic origin is below unbranched dorsal rays or just in

front. In our specimens collected from various locations from India to Nepal, showed that (n-13) the origin of dorsal fin is anterior to the pelvic fin. Pre-dorsal length is lesser (43.34-48.47 %SL) than pre pelvic length (46.75-51.84 %SL) and this showed the position of the dorsal fin being anterior to the pelvic fin origin. Distribution range of this species is wide spread from India to Nepal.

G. suhia was originally described from Gandak River in Saran, Bihar based on one specimen (Chaudhuri, 1912) and now the data provided here is based on two specimens. The main distinguishing feature between these two species in the meristic character is the lateral transverse scale rows (L.tr.) and few morphometric features. The synonymy of *G. chapra* and *G. godanahiai* is based on the overlapping meristic and morphometric characters. The main distinguishing character as proposed by Srivastava (1968) for *G. chapra* is having a black humeral spot or absent while *G. godanahiai* had 6-11 blotches on the dorsolateral margin from the posterior end of opercle to the base of caudal fin. It is observed that fresh specimens lack the spot or the blotches but after preservation there are blotches as mentioned in for *G. godanahiai*.

Comparative materials

Gudusia chapra: MSUMNH 131. 1ex, 101.57 mm SL, Sarayu River, U.P. collected by M. Arunachalam and team, 06 May 2010. CMA 74. 5ex, 88.80-94.26 mm SL, Sarayu River, U.P. 06 May 2010. MSUMNH 197. 1ex, 85.70 mm SL, Paniyohoya, Gandok nagar, Kusinnagar (Dt), U.P. collected by M. Arunachalam and team, 04 March 2013. CMA176. 2ex, 72.33-83.82 mm SL, Paniyohoya, Gandok nagar, Kusinnagar (Dt), U.P. collected by M. Arunachalam and team, 04 March 2013. CMA 179. 3ex, 86.01-96.86 mm SL. New Jalpaiguri, Super market, West Bengal, collected by M. Arunachalam and team, 27 November 2012. CAR 3. (1 ex.), 90.10 mm SL: Koshi River at Koshi Barrage, Bharadah VDC-1, Saptari (N 26°52' 907" E 86° 92' 83"; 98 msl), collected by Asha Rayamajhi, 23 April, 2014.

Gudusia shuhia: CMA 178. 2ex, 92.42-97.48 mm SL, Ganges River, Vijaya nagar (market collection), Kanpur, collected by M. Arunachalam and team, 11 July 2011.

ACKNOWLEDGMENTS

This research was supported in part by the Sri Paramakalyani Centre for Environmental Sciences,

(DST- Government of India -S/FST/ESI-101/2010), Manonmaniam Sundaranar University, Saint Louis University and the USA National Science Foundation Grants EF-0431326, DEB-1021840 and DBI-0956370 to RLM. This work was initiated, intended and completed as part of collaborative international initiatives to develop infrastructure in the taxonomy and systematics of fishes in Cypriniformes, likely the most diverse group of freshwater the world. The two initiatives Cypriniformes Tree of Life and All Cypriniformes Global Biodiversity Initiative (www.cypriniformes.org) have aided in this mission. Collections from Nepal come from the last author's Ph.D. programme in SPKCES, MSU.

REFERENCES

- Chaudhuri, B.L., 1912. Description of some new species of freshwater fishes from north India. *Rec. Ind. Mus.*, 35: 437-444.
- Day, F., 1878. *The Fishes of India; Being A Natural History of the Fishes Known to Inhabit the Seas and Fresh Waters of India, Burma, and Ceylon*. Dawson & Sons, London, pp. xx + 778.
- Day, F., 1889. *The Fauna of British India including Ceylon and Burma. Fishes*, Taylor & Francis, London, vols. I and II: pp. 548 and 509.
- Hubbs, C.L. and Lagler, K.F. 1964. *Fishes of the Great Lakes region*. University of Michigan Press, Ann Arbor, USA, pp. 213.
- Srivastava, G.J., 1965. *Fishes of Eastern Utter Pradesh*. 1st Edn., Vishwavidyoaya Prakastan, Varanasi, India, pp. 163.
- Strauss, R.E. and Bookstein, F.L., 1982. The truss: Body form reconstructions in morphometrics. *Syst. Zool.*, 31(2): 113-135.
- Whitehead, P.J.P., 1965. A preliminary revision of the Indo-pacific Alosinae (Pisces; Clupeidae). *Bull Brit. Mus. (Nat. Hist.) Zool.*, 12(4): 115-156.