Berita Biologi
Jurnal Ilmu-ilmu Hayati

10.55981/beritabiologi.2023.1973
P-ISSN 0126-1754
E-ISSN 2337-8751

MORPHOLOGICAL VARIATION OF *GLYPTOTHORAX PLATYPOGON* VALENCIENNES, 1840 IN SERAYU RIVER BANJARNEGARA AND RINGIN RIVER SEMARANG CENTRAL JAVA

[*Variasi Morfologi Ikan Kekel (Glyptothorax platypogon Valenciennes, 1840) dari Sungai Serayu Banjarnegara dan Sungai Ringin Semarang Jawa Tengah*]

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ABSTRACT

Glyptothorax platypogon is freshwater fish, it's potential to be an ornamental fish. Its need to be protected from extinction because population in other areas is till abundance. *G. platypogon* has reported that it's in Serayu River and based on pre-research observations found in Ringin River, Semarang, Central Java. The differences in the geographic location of the two rivers have the potential for the emergence of morphological variations of *G. platypogon*. Research on the morphology study of the *G. platypogon* from the Serayu River in Banjarnegara and the Ringin River has been conducted. This study describe morphological variations and provide information about the phenetic relationship between them. Sampling was carried out at Serayu River and Ringin River by direct observation and collection methods in the Field then continued at the Structure Laboratory of Biology Department State Islamic University Walisongo for observed morphometric and meristic,including 43 characters. Data was analyzed with the Kruskall Wallis test, Mann Whitney U test, PCA (Principal Component Analysis) and UPGMA (Unweighted Pair Group Arithmetic Average Method). The result showed that there were high morphological variations in the Allopatric population in Serayu River and Ringin River and there were low morphological variations in the Sympatric population in Serayu river. There were two clad taxa branching groups from Serayu and Ringin population which show morphological variation. UPGMA analysis and Euclidean distance show the population of Serayu River and Ringin River have a close phenetic relationship.

Keywords: Glyptothorax platypogon, Sisoridae, Morphometric, Meristic

ABSTRAK

Glyptothorax platypogon adalah salah satu jenis Ikan yang berpotensi sebagai ikan hias air tawar yang bernilai ekonomis. Ikan ini perlu dilindungi dari ancaman kepunahan karena dikhawatirkan akan terjadi penurunan populasinya di alam. *G. platypogon* dilaporkan terdapat di Sungai Serayu Banjarnegara dan berdasarkan observasi pra riset dijumpai di Sungai Ringin Semarang Jawa Tengah. Perbedaan letak Geografis kedua Sungai tersebut berpotensi terhadap munculnya variasi morfologi *G. platypogon*. Penelitian ini bertujuan untuk mengkaji variasi morfologi serta memberikan informasi tentang hubungan kekerabatan fenetik ikan *G. platypogon* dari Sungai Serayu dan Sungai Ringin. Pengambilan sampel dilakukan di Serayu stasiun 1 dan stasiun 2 serta Ringin dengan metode observasi dan koleksi langsung di lapangan kemudian dilanjutkan di Laboratorium Struktur jurusan Biologi UIN Walisongo Semarang untuk karakterisasi morfologi meliputi karakter morfometrik dan meristik mencakup 43 karakter. Analisis data dilakukan dengan menggunakan uji *Kruskall Wallis*, *Mann Whitney U test*,*PCA (Principal Component Analysis*) dan *UPGMA (Unweighted Pair Group Method Aritmatic Average).* Hasil penelitian menunjukkan bahwa terdapat variasi morfologi yang tinggi pada populasi allopatrik di Serayu dan Ringin dan terdapat variasi morfologi yang rendah pada populasi simpatrik antara sungai serayu stasiun 1 dan stasiun 2. Terdapat dua kelompok percabangan klad taksa yaitu dari populasi sungai Serayu dan Sungai Ringin yang menunjukkan adanya variasi morfologi. Analisis UPGMA dan Jarak Euclidean menunjukkan populasi Sungai Serayu dan Sungai Ringin memiliki hubungan kekerabatan yang dekat.

Kata Kunci: Allopatrik, Glyptothorax platypogon, morfometrik, meristik, simpatrik

INTRODUCTION

Glyptothorax platypogon is potential to be an ornamental fish. According to (Kottelat *et al.,* 1993) *G. platypogon* is distributed in Sumatra, Borneo, Java, and Malaya. It is need to be protected from extinction because it is feared that there will be a decline in population Reporting by Casal (2017) from the site Fishbase. The status *of G. platypogon* in IUCN is NE (*Not Evaluated*). In this case, the fauna reported to be threatened with extinction is only found in certain areas, its unknown another region. This status requires adequate information for assessing extinction risk based on the distribution and population of these fish. According to Yulperius (2006) in an effort to avoid extinction and restore endangered fish species, it is necessary to preserve fish resources, one of which is domestication. Before domestication, some research must be done, such as morphometric and meristic studies.

G. platypogon is reported to be found in Serayu River in Banjarnegara and based on pre-research observations found in Ringin River, Semarang, Central Java. The differences in the geographic

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**Diterima: 20 Desember 2019 - Diperbaiki: 06 Maret 2020 - Disetujui: 06 Juli 2020*

location of the two rivers have the potential for the emergence of morphological variation of *G. platypogon*. Information about the presence of *G. platypogon* fish in the Ringin River so far has not been reported, morphological variations are also not available. It is important to know the difference in character between the two population in different locations. Differences in the geographical location that affect the habitat and morphology of these fish species. Morphological characters based on previous observations. According to Franssen *et al.* (2013) variations and differentiation of morphological characters can be influenced by environmental conditions during ontogeny, food availability and predators, spawning areas, pollution intensity, water depth and anthropogenic pressure levels. The results of this study aim to provide information about diversity at the species level that occurs due to fish body respon towards environmental differences and also know taxonomically both populations Serayu and Ringin.

MATERIAL AND METHODS

This research is a field research with descriptive data analysis, with Survey method. The sample collection was carried out on November 2018-April 2019 in the Upper Serayu River, Tapen Village, Wanadadi District, Banjarnegara Regency, Central Java. Station 1 (coordinate: 7°23’59.6” LS ,109°35’54.2.BT), Station 2 (500 meter on distance from st. 1) (Coordinate:7°24’00.6” LS, 109°35’56.8.BT) (Figure 1) and in the Upper River Ringin, Keseneng Village, Sumowono District, Semarang Regency, Central Java (7°12’06.9”LS, 110°17’21.4”BT) (Figure 2). on this research measurements taken water quality (table 1), sample collection is done by using Seser (Portable lift Net), and Electrofishing which is adjusted to the condition of the collecting location. The sample collection refers to Romdon and Sukamto (2014), specific characteristics samples recorded such as body color, fin color and other characters that lost or changed if preserved. several samples were photographed with a digital camera. Each sample is labeled in the form of a code. samples put into a plastic box that has been filled with 4% formalin solution, by adjusting the body position and fins. Then taken to the laboratory and transferred into 70% alcohol.

Morphometric and meristic character observations were carried out using calipers mitutoyo with the accuracy of 0.1 mm. Observation of morphological characters refers to the method (Bookstein, 1982; Kottelat *et al.*, 1993; Moyon and Huidrom, 2017) include 43 characters. (Figure 3 and Table 2)

Table 1. Water quality test (methode and instruments). (*Uji kualitas air (metode dan instrumen)*).

Parameter	Unit	Metode	Instruments
physics:			
Temperatur	°c	Scale reading / *insitu*	Thermometer
Water depth	Meter	/ *insitu*	Metre gauge
wide	Meter		Mere gauge
Water Brightness	Meter	Visual/ *insitu*	*Secchi disc*
Water color	-	Visual	-
Waterflow velocity	m/s		Rope and float device
Substrat	-	Visual	-
Chemicals			
Ph		Elektromethric / *insitu*	pH meter
DO	mg/l	Elektromethric / *insitu*	DO meter
TDS	Ppm	scale / *insitu*	TDS meter

Figure 1. Location Map of Research in Tapen Village of Wanadadi District, Banjarnegara Regency, Central Java (Source: google map with modification). (*Peta Lokasi Penelitian, Desa Tapen Kecamatan Wanadadi, Kabupaten Banjarnegara, Jawa Tengah (Sumber: google map dengan modifikasi)*).

Figure 2. Location Map of Research in Keseneng Village, Sumowono District, Semarang (Source: google map with modification). (*Peta Lokasi Penelitian di Desa Keseneng, Kecamatan Sumowono, Semarang (Sumber: google map dengan modifikasi)*).

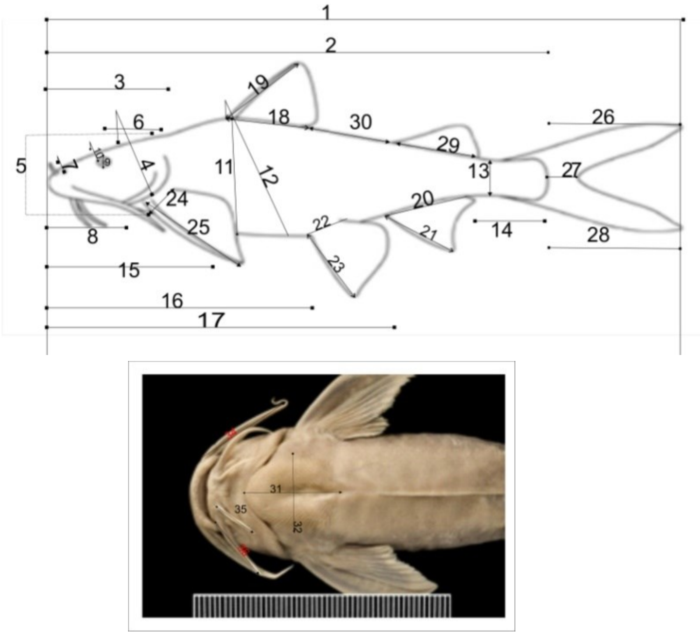

Figure 3. Morphometric characters of *G. platypogon* Karakter Morfometrik *G. platypogon* (source: Ng and Kottelat, 2016). (*Karakter morfometrik dari G. platypogon Karakter Morfometrik G. platypogon (sumber: Ng dan Kottelat, 2016)*).

Table 2. Morphometric and meristic characters of *G. Platypogon*. (*Karakter morfometrik dan meristik dari G. platypogon*).

No	Information (*Keterangan*)
1.	TL : Total Length
2.	SL : Standar Length
3.	HL : Head Length
4.	HW :Head Width
5.	HD:Head Depth
6.	HBEL :Head behind eye length
7.	ID : Internares Distance
8.	SnL :Snout Length
9.	ED : Eye diameter
10.	IOD : Interorbital Distance
11.	BD: Body Depth
12.	BW: Body Width
13	CPD: Cudal Peduncle Depth
14.	CPL: Caudal Peduncle Length

No	Information (*Keterangan*)
15.	PDD:Pre Dorsal Distance
16	PPD: Pre Pelvic Distance
17.	PAD: Pre Anal Distance
18.	DFBL:Dorsal Fine Base Length
19.	DoFL:Dorsal Fine Length
20.	AFBL ; Anal Fine Base Length
21.	AFL: Anal Fin Length
22.	PeBL :Pelvic fin Base Length
23.	PeFL:Pelvic Fin Length
24.	PFBL: Pectoral Fin Base Length
25.	PFL:Pectoral Fin Length
26.	CFUL : Caudal Fin upper Length
27.	CFML : Caudal Fin Middle Length
28.	CFLL:Caudal Fin Lower Length
29.	AFBL: Adipose Fin Base Length
30.	DAD ; Dorsal- Adipose Distance
31	T AAL: Thoraxic Adhessive Apparatus Length
32.	TAAW: Thoraxic Adhessive Apparatus width
33.	NBL : Nasal Length
34.	MxBL: Maxillar Length
35.	IMBL:intramandibular length
36	OMBL:outer mandibular Length
37	DFHR :Dorsal Fin hard Rays
38	DFSR: Dorsal Fin Soft rays
39	PeSR: Pelvic Soft rays
40	PFHR: Pectoral fin hard rays
41	PFSR: Pectoral fin soft rays
42	AFR:Anal fin Rays
43	CFR: Caudal fin Rays

Data analysis

Analysis of Quantitative Morphological Data of *G. platypogon*

Kruskall-Wallis Test

The Kruskall-Wallis test was carried out to identify which characters showed significant variation in the overall population being compared (multivariate population comparison). Data analyzed in the Kruskall-Wallis test were morphological data that had been compared with standard lengths and transformed with Log10. Then the data is processed using the SPSS program ver.19.

Two-Way Statistical Test with Mann-Whitney U

The two-way test with Mann-Whitney U is intended to determine morphological variations between two different populations (one population with another population) of *G. platypogon* found at several river points. Data analyzed in the Mann-Whittney U test were morphological data that had been compared with standard lengths and transformed with Log10. Then the data is processed using the SPSS program ver.19.

UPGMA (Unweighted Pair Group Arithmatic Average Method) Cluster Analysis

Morphological data were analyzed to obtain a dendogram of the entire *G. platypogon* population. The analysis procedure uses the asymmetric method with the following stages: Determination of the Operational Taxonomy Unit (OTUs) for morphological analysis, the OTUs is the populations of *G. platypogon*. Character selection is the determination of the measured character units including the morphological characters of the species in the form of morphometric and meristic characters. All morphological data were standarization with standard length parameters (SL) then transformed with Log10 to obtain data with a normal distribution. Determination of the euclidian distance and output in the form of a dendogram is performed by the UPGMA (Unweighted Pair Group Arithmetic Average Method) using the MVSP 3.2 program. Taxonomic distances of each population are calculated using the euclidian distance formula.

PCA Analysis (Principle Component Analysis)

In addition to UPGMA cluster analysis PCA analysis was also conducted to determine the pattern of *G. Platypogon* morphological variation between populations. Data were analyzed by PCA in the form of morphological data which had been standardization with standard length and transformed with Log10. Then the data is processed using MVSP 3.2 program to obtain the PCA ordination plot.

RESULTS

Observation of morphological variations in *G. platypogon* fish totaling 53 fish (5 in the location of Station 1 and 40 fish (stations 2) in Serayu, Banjarnegara Regency, Central Java and 8 in Ringin Semarang) begins with recording the condition of fish habitat (Table 1). Then proceed with some analysis. *G. platypogon* habitat condition recording is done to find out things that affect the morphological conditions of fish caused by differences in the habitat conditions of each. From the observations and measurements made, the following data are obtained (Table 3).

Table 3. The recording of *G. platypogon* habitat conditions. (*Pencatatan Habitat ikan G. platypogon*).

Parameters	Serayu	Ringin
Temperature (^{0}C)	29	24
Brightness (cm)	20	72,5
Width (m)	16,9–17,4	8–11
Water colors	Murky Brown	Clear-greenish
Depth (cm)	56–78	22–85
Waterflow velocity (m/s)	0,5	0,6
Total dissolved solids (ppm)	125	82
Waters bottom	Rocks	Rocks
Substrate	Gravel, sandy	Gravel
Ph	7,5	6,9
DO (ppm)	5,7	8,4

Morphological variation of *G. platypogon* fish from Serayu and Ringin river.Morphometric and Meristicto find out morphological variations between locations, including the Kruskal Wallis test, the Mann Whittney Test and Principal Component Analysis (PCA). The results obtained are as follows:

Kruskall-Wallis Test of Morphological Character of *G. platypogon*

Table 4. The Average value, standard deviation, minimum, maximum and analysis results of the Kruskall-Wallis Test of Morphological Character of *G. platypogon* Fish Throughout the Location. (p significant ≤0.05; N: total population; ns: non significant in the Kruskall-Wallis test; *: significant test results). (*nilai rata-rata,standar deviasi, minimum, maksimum dan Analisis hasil Kruskall Wallis terhadap karakter Morfologi ikan G. platypogon (Signifikansi ≤0.05, n:total populasi ; ns; non signifikan , *: signifikansi hasil uji*).

Morphology Characters	Location			Kruskall Wallis test
	Serayu 1 N = 5	Serayu 2 N = 40	Ringin N= 8	
Morfometrik				
TL	57,8 ± 9,4 46,6–68,0	59,2 ± 9,7 42,4–75,8	50,2 ± 5,1 41,0–58,0	X^2 = 0,00 P = 1,00 **ns**
SL	47,0 ± 8,6 38,4– 58,9	47,3 ± 8,1 34,2–61,6	42,5 ± 5,0 32,2–50,2	X^2= 5,346 P = 0,069 **ns**
HL	11,1 ± 2,7 7,6–15,0	11,8 ± 2,2 8,0–16,6	9,4 ± 0,8 8,0–10,6	X^2=16,96 P = 0,00 *
HW	8,8 ± 2,4 7,6–15,0	8,6 ± 2,1 5,2–12,8	6,3 ± 0,9 5,2–8,2	X^2=12,956 P = 0,002 *
HD	6,1 ± 2,4 3,4–9,0	5,8 ± 1,8 3,4–12,9	3,7 ± 0,9 2,8–5,8	X^2 =13,469 P = 0,001 *
HBEL	5,3 ± 1,3 3,9–6,6	4,7 ± 1,2 2,4–6,8	3,1 ± 0,5 2,4–3,7	X^2 = 10,980 0,004 *
ID	0,4 ± 0,2 0,2–0,8	0,7 ± 0,6 0,1–2,4	0,2 ± 0,1 0,1–0,4	X^2 =7,260 P= 0,027 *
SnL	2,0 ± 0 2,0–2,1	4,5 ± 1,0 2,7–6,6	2,6 ± 0,5 2,1–3,4	X^2 =30,672 P=0,000 *
ED	0,2 ± 0 0,1–0,2	0,2 ± 0,2 0,1–0,8	0,3 ± 0,2 0,2–0,6	X^2 =6,271 P= 0,043 *
IOD	3,1 ± 1,1 2,0–4,2	2,9 ± 0,7 1,2–4,7	2,4 ± 0,2 2,1–2,6	X^2 =2,092 P= 0,351 **ns**
BD	6,7 ± 1,9 4,2–9,2	7,0 ± 2,6 3,2–12,4	3,5 ± 0,8 2,2–4,4	X^2 = 18,052 P = 0,000 *
BW	5,0 ± 2,8 2,2–8,6	5,2 ± 1,9 2,4–8,9	3,5 ± 0,8 2,3–5,2	X^2 = 5,068 P = 0,079 **ns**
CPD	3,3 ± 1,4 1,1–4,8	3,0 ± 1,4 0,9–5,8	1,6 ± 0,4 1,0–2,1	X^2 =10,344 P = 0,006 *
CPL	6,1 ± 1,5 4,0–7,9	7,2 ± 1,6 3,7–9,8	7,4 ± 1,6 4,7–10,4	X^2 =13,662 P = 0,001 *
PDD	16,3 ± 2,8 13,0–20,0	16,8 ± 4,1 7,8–23,6	14,6 ± 0,9 13,3–15,6	X^2 =2,473 P = 0,290 **ns**
PPD	23,8 ± 5,2 18,0–30,0	23,4 ± 4,6 17,4–31,8	20,2 ± 1,8 16,6–23,2	X^2 =0,663 P = 0,718 **ns**
PAD	32,2 ± 6,9 25–41,0	32,4 ± 5,6 25,0–42,2	28,1 ± 2,3 24,4–31,4	X^2 = 0,218 P = 0,897 **ns**

Morphology Characters	Location Serayu 1 N = 5	Serayu 2 N = 40	Ringin N= 8	Kruskall Wallis test
Morfometrik				
DFBL	4,0 ± 1,5 2,4–5,7	3,1 ± 1,0 1,3–4,7	3,2 ± 0,5 2,4–3,8	X^2 =2,781 P = 0,249 **ns**
DoFBL	6,6 ± 1,0 5,5–7,9	7,0 ± 1,4 4,2–9,8	5,1 ± 0,8 4,1–6,2	X^2 = 11,485 P = 0,003
AFBL	5,1 ± 2,2 2,4–5,7	4,2 ± 9,8 4,2–9,8	2,7 ± 0,7 1,4–3,6	X^2 =10,654 P = 0,005 *
AFL	7,5 ± 2,2 4,0–9,4	8,1 ± 1,8 5,3–12,8	5,6 ± 0,7 4,4–6,6	X^2 = 11,091 P = 0,004
PEBL	0,5 ± 0,3 0,1–0,8	0,6 ± 1,1 0,1–6,8	0,2 ± 0,0 0,1–0,2	X^2 = 3,666 P = 0,160 **ns**
PeFL	5,3 ± 1,4 3,0–6,6	5,8 ± 1,1 3,4–8,1	4,4 ± 0,8 3,2–5,8	X^2 = 7,760 P = 0,021 *
PFBL	1,9 ± 1,0 0,8–3,6	1,5 ± 0,7 0,2–2,4	0,6 ± 0,3 0,4–1,2	X^2 = 13,448 P= 0,001 *
PFL	8,8 ± 1,7 6,6–11,0	9,0 ± 2,0 4,2–12,6	7,6 ± 1,5 5,6–9,6	X^2 = 0,536 P = 0,765 **ns**
CFUL	9,4 ± 2,5 6,0–11,5	9,8 ± 1,9 5,2–13,6	6,3 ± 0,8 4,8–7,4	X^2 =14,968 P = 0,001 *
CFML	5,2 ± 0,4 5,0–5,9	4,3 ± 1,0 2,4–6,2	2,0 ± 1,0 0,2–3,6	X^2 =20, 639 P = 0,000 *
CFLL	10,3 ± 1,6 7,8–11,5	9,8 ± 1,7 6,2–13,4	6,3 ± 0,7 4,0–7,0	X^2 = 19,272 P = 0,000 *
AFBL	5,3 ± 1,6 3,1–6,8	4,5 ± 1,5 2,0–8,0	3,2 ± 1,0 1,2–4,4	X^2 = 7,418 P = 0,025 *
DAD	9,2 ± 3,2 5,8–14,4	10,0 ± 2,3 5,4–14,4	8,9 ± 1,5 6,4–11,1	X^2 = 1,936 P = 0,380 **ns**
TAAL	5,9 ± 1,8 4,2–8,1	6,1 ± 1,5 3,0–9,2	4,2 ± 1,0 2,0–5,4	X^2 = 12, 858 P = 0,002 *
TAAW	4,4 ± 1,3 3,5–6,6	4,7 ± 1,4 2,2–7,2	3,5 ± 0,2 3,2–3,8	X^2 = 4,466 P = 0,107 **ns**
NBL	2,2 ± 0,8 0,8–2,6	1,8 ± 0,7 0,2–3,5	0,5 ± 0,5 0,1–1,4	X^2 = 16,549 P = 0,000 *
MxBL	8,8 ± 2,1 6,4–10,8	8,8 ± 2,5 4,4–14,4	7,6 ± 1,2 5,4–8,6	X^2 =1,081 P = 0,583 **ns**
IMBL	2,0 ± 1,0 0,6–3,2	2,4 ± 0,8 0,8–3,6	1,4 ± 0,9 0,2–2,4	X^2 =8,388 P = 0,015 *
OMBL	5,0 ± 1,3 3,8–7,0	4,5 ± 1,4 1,2–6,6	3,0 ± 1,2 1,2–5,4	X^2 = 11,145 P = 0,004 *
Meristik				
DFHR	1,0 ± 0,0 1–1	1,0 ± 0,0 1–1	1,0 ± 0,0 1–1	X^2 = 0,000 P = 1,00 **ns**
DFSR	7,4 ± 0,9 7–9	5,2 ± 0,5 5–7	5,9 ± 0,4 5–6	X^2 =22, 601 P = 0,00 *
PeSR	5,6 ± 0,5 5–6	5,8 ± 0,5 5–7	5,8 ± 0,7 4–6	X^2 = 0,892 P=0,640 **ns**
PFHR	1,0 ± 0,0 1–1	1,0 ± 0,0 1–1	1,0 ± 0,0 1–1	X^2 = 0,000 P = 1,00 **ns**
PFSR	7,0 ± 0,0 7–7	5,4 ± 0,8 4–7	5,8 ± 0,7 5–7	X^2 = 5,736 P = 0,057 **ns**
AFR	7,8 ± 1,5 6–10	7,5 ± 0,8 6–10	8,5 ± 1,1 6–9	X^2 = 12,420 P = 0,002 *
CFR	14,0 ± 0,0 14–14	13,6 ± 0,9 11–15	14,0 ± 0,0 14–14	X^2 =0,000 P= 1,00 **ns**

Morphological Analysis with the Mann Whittney Test

From the results of the Kruskal Wallis test, it is known that there are 23 character differences between among populations. Therefore, the test is continued with the Mann Whitney test, contains the results of the Mann Whitney test which shows variations in character between populations.

Table 5. Morphological Analysis with the Mann Whittney Test (*Analisis Morfologi dengan uji Mann Whitney*)

Lokasi	Serayu 1	Serayu 2	Ringin
Serayu 1	-	-	
Serayu 2	11,6 % (5)	-	-
Ringin	39,5 % (17)	65 % (28)	-

Morphological Analysis of *G. platypogon* with Principal Component Analysis (PCA)

The results of the PCA analysis of the morphology of *G. platypogon* in Serayu and *G. platypogon* in the Ringin River can be seen in Figure 4.

Body color pattern of *G. platypogon*

Furthermore, morphological observations of fish coloring patterns were also carried out.The results are shown in Figure 5 which shows the differences in the coloring patterns of the *G. platypogon* fish in Serayu and Ringin.

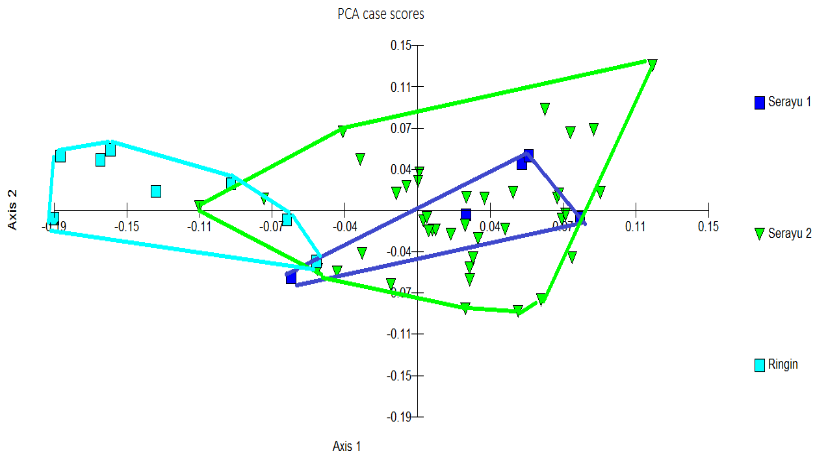

Figure 4. Results of PCA ordination plot on the morphological character *of G. platypogon* in Serayu and Ringin. (*Hasil plot ordinasi analisis PCA terhadap karakter morfologi G. platypogon dari Serayu dan Ringin*).

(a) (b)

Figure 5. *G. platypogon* (Dorsal view) (a) from the Serayu River (*dari Sungai Serayu*) (b) from the Ringin River (*dari Sungai Ringin*) Pictured by Researcher (*Gambar oleh: peneliti*).

(a)

(b)

Figure 6. *G. platypogon* (Lateral view) (a) from the Serayu river (*dari Sungai Serayu*) (b) from the Ringin River (*dari Sungai Ringin*) Picture by Researcher (*Gambar oleh: peneliti*)

Kinship relationship *G. platypogon* population from Serayu River and Ringin River based on morphological analysis

The results of the analysis of the morphology of *G. platypogon* in Serayu and G. *platypogon* in the Ringin River can be seen :

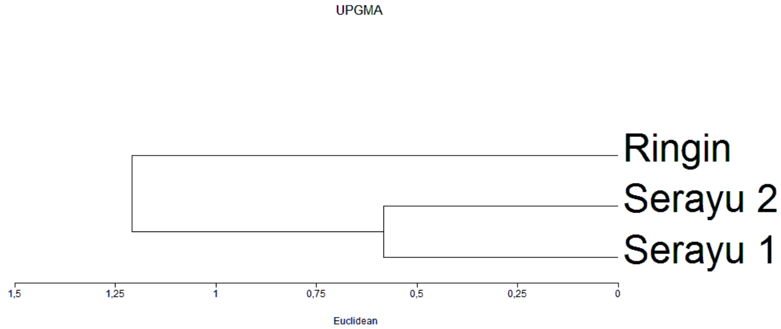

Figure 7. Dendogram Population of *G. platypogon* fish from the Ringin and Serayu Rivers. (*Dendogram Hasil analisis Morfologi ikan G. platypogondari populasi Sungai Ringin dan Serayu*).

Table 5. Euclidean Distance Kinship *G. platypogon* fish populations from the Ringin and Serayu Rivers. (*Jarak Euclidean hubungan kekerabtan ikan G. platypogondari populasi Sungai Ringin dan Serayu*).

Lokasi	Serayu 1	Serayu 2	Ringin
Serayu 1	0,000		
Serayu 2	0,583	0,000	
Ringin	1,245	1,170	0,000

DISCUSSION

The results of the Kruskall-Wallis analysis for the entire population (Table 1) reveal that there is a high morphological differentiation in *G. platypogon* populations, both the Simpatric population in the Serayu River and the Allopatric population found in the Ringin River, from the 43 characters measured, 23 characters showed significant differentiation in all *G. platypogon* populations.The characters consisted of 21 morphometric characters and 2 meristic characters namely, head length (HL) head width (HW), head Depth (HD), head behind eyeslength (HBEL), internares distance (ID), snout length (SNL), eye diamater (ED), body depth (BD), caudal peduncledepth (DCP), caudal pedunclelength (CPL), anal-fin base length (FBL), pelvic fin length (PeFL), pectoral fin base length (PFBL), caudal fin upper length (CFUL), caudal fin middle length (CFML), caudal fin lower length (CFLL), adipose fin length (AFL),toraxic adhesive apparatus length (TAAL), nasal barbels length (NBL), inner mandibular length (IMBL), outer mandibular barbels length (OMBL), dorsal fin soft rays (DFSR), anal fin rays (AFR).

High morphological character differentiation in *G. platypogon* indicates that this species is thought to haveahigh adaptability to the environment. This form of adaptation will help this species survive from changing environmental conditions. The morphological characters that varies is a form of adaptation within a population to their environment (Aprilian *et al.,* 2016). The phenotype of variation can occur without being followed by the genetic changes but only a form of plasticity as a manifestation of ecological differences such as geographical isolation and environmental factors (Næsje *et al*., 2004).

Based on the analysis of the Mann-Whitney U test (Table 3), it is known that the population of *G. platypogon* which shows the highest differentiation is between the population of Serayu station 2 and the Ringin river, which is 65% (28 characters) morphologically. Significantly different characters include characters on the head (HL, HW, HD, HBEL, ID, SnL, ED), the truncus consists of (SL, BD, BW), the tail and fins consist (DCP, LCP, DFBL, AFBL, AFL, PeFBL, PFBL, CFUL, CFML, CFLL, AFBL, DFSR, and AFR), TAAL, TAAW, Barbels characters (NBL, IMBL, OMBL).

Based on the Mann-Whitney U test it is known that morphological characters significantly different in Head (HL, HW, HD, HBEL, ID, SnL, ED), Serayu and Ringin River have different levels of water brightness, Serayu River brightness of 20 cm, while the Ringin River is 72.5 cm, so that is obtained. *G. platypogon* in Serayu has a larger head and eye diameter Characters than in Ringin River, In accordance with Burhanuddin (2008) states that fish that live in a low level of water brightness have a larger head and eye shape, This is due to the more developed midbrain (mesencephalon), mesencephalon in fish functions as the center of vision.

Significant differences in truncus characters (SL, BD, BW) and fin characters (DCP, LCP, DFBL, AFBL, AFL, PeFBL, PFBL, CFUL, CFML, CFLL, AFBL, DFSR, and AFR). This is thought to be related to the alleged differences in living conditions or habitats. the habitat conditions of the Serayu and Ringin Rivers recorded differences between the waterflow velocity, depth, water brightness, and water color, (Table 2). based on measurements (Table 4), *G. platypogon* from Serayu River has a larger body than Ringin River which has slim body. *G. platypogon* from Serayu River has a greater fin character compared to *G. platypogon* from Ringin River, this is due to the factor of current velocity and depth of the river, thus allowing fish to be more active in moving. As disclosed Nuryanto (2001) that the most influential environmental factor on the morphological variation of a fish species is the physical factor of the waters, especially currents. Significant differences also occur in barbels character (NBL, IMBL, OMBL), it can be seen that Serayu population has a relatively longer barbels compared to the Ringin population, this is related to the barbels function as a food detector (Kottelat, 1993). Serayu has a murky brown water color while the Ringin River has a greenish clear water color, this allows the *G. platypogon* fish in the Serayu river to function more often when their foraging for food, Because it is considered a change in barbells in connection with this condition.

High morphological variations in the population of *G. platypogon* in Serayu and *G. platypogon* in Ringin. This relates to morphological studies conducted by Rahmadhani (2016) on *Hampala macrolepidota* in Singkarak and *Hampala* sp. in Maninjau–that the level of morphological differentiation in the allopatric population (Lake Maninjau vs. Lake Singkarak) was higher than the sympatric population.

It is also explained by (Lostrom *et al.*, 2015) that morphological and genetic changes can be induced by external factors such as geographical isolation, differences in environmental factors during ontogeny, the presence of predators and limited food availability. This indicates that apart from differences in habitat type (ecology) factors, isolation between populations also plays a role in triggering morphological variations in *G. platypogon* in Serayu and Ringin River mainly due to the absence of inter-population crossings and interrupted gene flow.

The population of *G. platypogon* which shows the lowest variation is between the population of Serayu River Station 1 and Serayu River Station 2 consisting of five morphologically significant characters. Snout length (SnL), Caudal Peduncle Length (CPL), Caudal fin Middle Length (CFML), dorsal fin soft ray (DFSR) and pectoral fin soft rays (PFSR). This is because both populations are sympatric populations. species that inhabits the same habitat will exhibit a slight variation in character because gene flow is maintained and the environment does not have a significant impact. This is in line with the research of (Wibowo, 2012) who conducted a phenotypic study on *Chitala lopis* fish in the Kampar River, Riau. It was reported that the phenotype character of the *C. lopis* fish at Langgam Station was not much different from that of the Rantau Baru station. This is because fish at Langgam Station migrate to the Rantau Baru Station which is located downstream so that the gene flow from the two stations is still present.

PCA analysis results of *G. platypogon* populations from several locations shows eigenvalues 1 (0.287) and eigenvalues 2 (0.114) with cumulative percentages of 34,133 on PC1 and 47,671 on PC2. The coefficient values on PCA 1 are all positive and negative and the coefficient values on PCA 2 are also positive and negative. According to Jeong *et al.* (2010) *in* Aprilian (2016) positive values indicate variation and negative values indicate no variation. is known that some individuals experience variations in morphological characters and variations are based on size. Wolpoff (1999) explains that the process of evolution carries certain consequences, including changes in adaptation patterns, population diversity and morphological variations related to adaptation to the environment, mutations and selection.

Variations in the morphological character of *G. platypogon* occur because of the adaptation to differences in environmental conditions shown in Table 2. (Franssen *et al.,* 2013) states that environmental conditions will lead to morphological changes in the population. Based on the results of the PCA analysis in Figure 4 shows that there are some individuals who have spread. Individuals who are separated from the group are thought to start experiencing changes in morphological character due to responses to environmental changes.

The PCA ordination plot in Figure 4 shows that the population at each location began to spread but that overlapping still occurred in some individuals. Some overlapping individuals are caused by having some of the same morphological characteristics.

The Ringin River population is seen as separating serayu population this is because the population of the Serayu river is a sympatric population, while the Ringin river is allopatric. According to Campbell (2000) that sympatric populations occur because of the absence of geographical isolation. Santoso (2008) added that in the sympatric population there is no geographical barrier which prevents the meeting between among population so naturally the opportunity to hybridize and mix between populations is very high especially among fellow populations.

The difference between *G. platypogon* from the Ringin River is slightly different from that caught in the Serayu River, especially in the pattern of coloring the body parts and fins, *G. platypogon* from the Ringin river is more transparent and the coloring pattern of the fin is more pale and faint. Significant differences were seen in the tail fin color pattern (Figure 6). According to Aprilian (2016) places that have little light intensity or shady places can affect the body color of the fish to become dark. Sukiya (2001) states that in most fish, colors show adaptation to the environment so that fish get protection from the background color of their place of life. Fish that live on a basis whose gradual brightness causes the color of the body of the fish to have a dark and light line on its body.

Besides the fading of body color can be caused by the pigment contained in fish can not be spread evenly (Moyle and Cech, 2000). Budiharjo (2001) and Said *et al.* (2005) consider the pigment found in fish is melanofor (black and brown). Melonophor pigment is a pigment that darkens the dark color (Moyle and Cech 2000). The fading of the body color of *G. platypogon* caught in the Ringin River is thought to be caused by the presence of melanophor pigment contained in the body of the fish which is not spread evenly.

Coloring pattern is a specific characteristic, because it can change according to age, time, or the environment in which the fish is found. This is an important part in describing each species, for example coloring patterns are species specific, condition of reproductive organs, sex. The main problem in coloring when used as a taxonomic tool is high subjectivity in describing fish (Wahyuningsih, 2006).

UPGMA analysis provides information on the phenetic kinship of *G. platypogon* fish from Serayu River and Ringin River. Figure 7 shows that *G. platypogon* is differentiated into two main clusters, first cluster consists of Ringin River population, the second cluster consists of Serayu River Station 1 and Station 2. The results of cluster analysis are shown in Table 4. The euclidian distance of 0.583 between the population of Serayu River Station 1 and Station 2 illustrates the level of character variation betwen them which is relatively lower than compared to the euclidian distance between the population of Serayu River 1 and Ringin River (1,245). According to Putra (2014) the closer of euclidian distance, variation between populations is lower based on morphological characters tested, and the otherwise getting further the euclidian distance, the variation between populations is higher being compared.

In the dendogram (Figure 7) it can be seen that the population of the Ringin River is separated from the locations of the Serayu 1 and Serayu 2 Rivers which are joined in one clad. The lowest morphological variation is the location of Serayu 1 and Serayu 2, the highest variation is in Serayu 1 and Ringin River. From the results of the Euclidean cluster analysis it can be seen that the population of *G. platypogon* fish originating from the waters habitat of the Serayu River has a closer kinship compared to the fish populations originating from the Ringin River, this is because the two populations of the Serayu River are Simpatric populations, in this case gene flow is maintained, whereas between the Serayu River and the Ringin River allows for Geographic Isolation, but in general the euclidean distance indicates kinship between close populations. This makes it possible to make the assumption that all three populations are the same species.

This result is supported by the results of the previous PCA analysis (Figure 7) which shows that some individuals from the Ringin River are far apart from other locations, especially with the Serayu River 1. Individuals at the Serayu River 1. location are in a clad close to the Serayu River 2. Based on the value of character variation (Table 4), the locations with the most varied characters are Serayu 1 River and Ringin of 1,245. This result is in accordance with the PCA plot image (figure 4) which shows some characters have a considerable distance between the two locations compared to other locations and the lowest morphological variation values are Serayu 1 and Serayu 2, which is 0.583. Based on the results obtained it appears that indeed ecological factors influence morphological variations in *G. platypogon*.

From the overall analysis results, namely the Kruskal Wallis, Mann Whitney, PCA and UPGMA tests, it appears that the presence of *G. platypogon* fish in two different locations shows morphological variations. Béland (2004) state that each species has a certain geographical distribution that is controlled by the physical conditions of its environment.

Therefore the distribution and morphological variations that emerge is a response to the physical environment in which the species lives. Morphological character variations can be caused by genetic factors and environmental differences.

G. platypogon that live in different habitats, in this case between the Serayu River and Ringin River is very possible for geographical isolation (Cabej, 2019) added that geographic isolation is one of the initial causes of speciation. This process can be observed from changes and differences in taxonomic characters found in a population (Schluter and McPhail, 1992)

The occurrence of geographical isolation also allows for inbreeding. With the occurrence of inbreeding means there is no gene flow into the population. In a small population, long-term inbreeding allows a nearly uniform arrangement of genes in that population (Mettler and Gregg, 1969). Therefore, differences in fish populations based on morphological variations need to be tested with genetic evidence to confirm that these variations also represent reproductive isolation and not just due to environmental differences (Tzeng, Chiu and Yeh, 2001).

CONCLUSION

There is a high morphological variation in the Allopatric population in the Serayu River and the Ringin River, at 65% (28 characters) morphology that is significantly different from the 43 characters measured, while there is a low morphological variation in the Simpatric population of *G. platypogon* in the Serayu River, that is, of the 43 characters measured consisted of 11.6% (5 characters) morphologically significantly different. In addition, there are also differences in the color pattern of *G. platypogon* in the Serayu River population and the population in the Ringin River. There are two groups of taxa clad branching, namely the population of Serayu River and Ringin River which show morphological variations. UPGMA analysis and Euclidean Distance show that Serayu River and Ringin River populations have close kinship.

ACKNOWLEDGEMENT

We would like to thank the institutions and individuals that made our study possible: Biology Department-Walisongo State Islamic University, Semarang, Gema Wahyudewantoro and Dr. Haryono (Research Center for Biology-Zoology–LIPI), fishermen at Wanadadi and Keseneng for help during field work.

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