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OROL DENGIZI HAVZASI ENDEMIGI *PARACOBITIS LONGICAUDA* (KESSLER, 1872)NING TAKSONOMIK TAHLILI (TELEOSTEI: NEMACHEILIDAE)

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Paracobitis urug‘i vakillari dorsal yog‘ do‘ngligi mavjudligi bilan Nemacheilidae oilasining boshqa vakillaridan ajralib turuvchi yalangbaliqlar bo‘lib, ularning 13 valid turi ma’lum. Orol dengizi havzasida ushbu urug‘ning faqatgina bir turi – *Paracobitis longicauda* Kessler, 1872 qayd etilgan bo‘lib, u Amudaryo va uning irmoqlari, Zarafshon hamda Tajan havzalarida uchraydi. *Paracobitis longicauda* ning mustaqil tur sifatida validligi molekulyar-genetik darajada o‘rganildi. Tadqiqot natijalariga ko‘ra, uning boshqa urug‘doshlari bilan COI barkod geni asosidagi genetik masofasi (K2P) 6,7–11,2% ni tashkil etdi. *Paracobitis longicauda* turli populyatsiyalari orasidagi ayrim morfologik farqlar tur ichidagi o‘zgarishlar natijasi yoki *P. longicauda* nomi ostida bir necha tur mavjudligi holatiga aniqlik kiritish uchun tez evolyutsiyalanuvchi DNK markerlardan foydalanish hamda chuqur morfologik-taksonomik tekshiruv o‘tkazish talab etiladi.

Kalit so‘zlar: yalangbaliqlar, Orol dengizi havzasi, *Paracobitis*, filogenetik tahlil, DNK barkoding, chuchuk suv baliqlari.

Представители рода Paracobitis — вьюны, отличающиеся от других представителей семейства Nemacheilidae наличием спинного жирового гребня, из которых в настоящее время насчитывается 13 видов. В бассейне Аральского моря отмечен только один вид этого рода — P. longicauda Kessler, 1872, причем этот вид встречается в бассейнах Амударьи и ее притоков, Зерафшана и Таджана. Валидность P. longicauda как самостоятельного вида изучена на молекулярно-генетическом уровне. По результатам исследования генетическая дистанция (K2P) между ним и другими родственниками по гену штрих-кода COI составила 6,7–11,2%. Использование быстро развивающихся ДНК-маркеров и тщательное морфолого-таксономическое исследование требуется для выяснения того, являются ли некоторые морфологические различия между разными популяциями P. longicauda результатом внутривидовой изменчивости или существования нескольких видов под названием P. longicauda.

Ключевые слова: *вьюны, бассейн Аральского моря, Paracobitis, филогенетический анализ, ДНК-штрихкодирование, пресноводные рыбы*.

KIRISH

Paracobitis Bleeker, 1863 urug‘i daryo yalangbaliqlari (Nemacheilidae) oilasi ichidagi kichik baliqlar guruhlaridan biri bo‘lib, dorsal qismida, orqa va dum suzgich qanotlari oralig‘ida dorsal yog‘ do‘ngligi (dorsal adipose crest) borligi bilan ajralib turadi. Ushbu urug‘ Bleeker (1863) tomonidan *Cobitis malapterura* uchun tavsiflangan bo‘lib [1], urug‘ga kiruvchi yalangbaliq turlari o‘tgan vaqt mobaynida bir necha marotaba o‘zining taksonomik o‘rnini almashtirishiga to‘g‘ri kelgan. Bugungi kunda urug‘ o‘z ichiga 13 valid turni birlashtiradi. Bular: *P. abrishamchianorum* Mousavi-Sabet, Vatandoust, Geiger & Freyhof, 2019 (Eronda – Tajan, Siah, Talar, Babol, Haraz va Kashpal daryolari hamda Kaspiy dengizi havzasining janubiy qismi), *P. atrakensis* Esmaeili, Mousavi-Sabet, Sayyadzadeh, Vatandoust & Freyhof, 2014 (Eronning shimoliy-sharqiy qismi – Kaspiy dengizi hamda Kavir havzasi), *P. basharensis* Freyhof, Esmaeili, Sayyadzadeh & Geiger, 2014 (Eronda – Dajla daryo havzasi), *P. ghazniensis* (Bănărescu & Nalbant, 1966) (Afg‘oniston endemigi), *P. hircanica* Mousavi-Sabet, Sayyadzadeh, Esmaeili, Eagderi, Patimar & Freyhof, 2015 (Eron – Kaspiy dengizi havzasining janubiy qismi), *P. longicauda* (Kessler, 1872) (Markaziy Osiyoda – O‘zbekiston, Turkmaniston, Afg‘oniston,

Eron suv havzalarida ham bo‘lishi mumkin), *P. malapterura* (Valenciennes, 1846) (Eron va Iroqda – Namak ko‘li havzasi hamda Kavir havzasining sharqiy qismi), *P. molavii* Freyhof, Esmaeili, Sayyadzadeh & Geiger, 2014 (Eron va Iroqda – Dajla daryosi havzasi), *P. persa* Freyhof, Esmaeili, Sayyadzadeh & Geiger, 2014 (Eronda – Kur daryosi havzasi), *P. rhadinaea* (Regan, 1906) (Eron va Afg‘onistonda – Hilmand va Sistan daryolari havzasi), *P. salihae* Kaya, Turan, Kalayci, Bayçelebi & Freyhof, 2020 (Turkiyada – Göksu daryosi havzasi), *P. starostini* (Parin, 1982) (Turkmaniston endemigi) va *P. zabgawraensis* Freyhof, Esmaeili, Sayyadzadeh & Geiger, 2014 (Turkiya va Iroqda) [2].

Paracobitis urug‘i vakili sifatida kashf etilgan *P. acuticephala* Zhou & He, 1993; *P. anguillioides* Zhu & Wang, 1985; *P. berezowskii* Günther, 1896; *P. erhaiensis* Zhu & Cao, 1988; *P. longidorsalis* Yang, Chen & Kottelat, 1994; *P. nanpanjiangensis* Min, Chen & Yang, 2010; *P. oligolepis* Cao & Zhu, 1989; *P. wujiangensis* Ding & Deng, 1990 o‘tkazilgan morfologik va molekulyar tadqiqotlar natijasida *Homatula* Nichols, 1925 urug‘iga, *P. longibarbatus* Chen, Yang, Sket & Aljancic, 1998; *P. maolanensis* Li, Ran & Chen, 2006 esa *Troglonectes* Zhang, Zhao & Tang, 2016 urug‘iga, *P. porterodorsalus* Li, Ran & Chen, 2006 bo‘lsa *Triplophysa* Rendahl, 1933 urug‘iga ko‘chib o‘tdi [2]. *Paracobitis iranica* Nalbant & Bianco, 1998 *P. malapterura* ning; *P. macmahoni* (Chaudhuri, 1910) va *P. vignai* Nalbant & Bianco, 1998 esa *P. rhadinaea* larning sinonimlari ekanligi ma’lum bo‘ldi [3, 4, 5]. Vyetnam suv havzalaridan kashf etilgan *P. hagiangensis* Nguyen, 2005 hamda *P. phongthoensis* Nguyen, 2005 Vyetnam ixtiofaunasining kompleks taksonomik reviziyasi natijasida *Schistura caudofurca* (Mai, 1978) ning sinonimi ekanligi qayd etildi [6].

Markaziy Osiyoda Orol dengizi havzasiga mansub suv havzalarida *Paracobitis* urug‘ining yagona vakili – *P. longicauda* uchraydi. U dastlab K.Kessler (1872) tomonidan Oqdaryo havzasidan (O‘zbekiston) *Cobitis* urug‘i vakili sifatida tavsiflangan [7]. Keyinchalik L.Berg (1949) uni *Nemacheilus* urug‘iga (*N. malapterarus* ning sinonimi sifatida) kiritdi [8]. *Paracobitis* urug‘iga esa ilk marotaba P.Bănărescu & T.Nalbant (1995) ning yalangbaliqlar oilasi urug‘larining taksonomik tahlili asosida kiritildi [9]. Ushbu tur asosan Amudaryo hamda uning ko‘plab irmoqlarida (Kofirnihon, To‘palang, Qoratog‘, Surxondaryo, Sherobod, Zarafshon daryolari) uchraydi [10]. O‘zbekistondan tashqari u Afg‘oniston va Turkmanistonda (Tajan va Murg‘ob daryolari) tarqalgani ma’lum [11, 12]. Mazkur turning Eron suv havzalarida tarqalganligi hozircha bahs mavzusi hisoblanadi. Boisi Jouladeh-Roudbar (2020) *P. longicauda* Eron hududida Hari daryosida uchrashini qayd etsa [13], Eagderi (2022) esa bu turning Eron hududidan tutilgan tasdiqlangan namunasi yo‘qligi sabab Eron chuchuk suv baliqlari ro‘yxatidan vaqtincha chiqarish lozimligini ta’kidlaydi [14].

Sheraliyev, Peng (2021) tomonidan O‘zbekiston baliqlarini tadqiq etish jarayonida *P. longicauda* ilk marotaba molekulyar-genetik jihatdan o‘rganildi [10]. Biroq Orol dengizi havzasida *P. longicauda* dan boshqa *Paracobitis* turlari bo‘lmaganligi uchun tadqiqotda bu turni o‘zining boshqa urug‘doshlari bilan solishtirish natijalari keltirib o‘tilmagan [10]. Ushbu tadqiqotda *P. longicauda* ning taksonomik jihatdan validligi hamda filogenetik o‘rni molekulyar-genetik tekshiruvlar natijalari asosida tahlil qilindi.

MATERIAL VA USULLAR

Mazkur tadqiqotga 2016–2023-yillar davomida Surxondaryo viloyati hududidagi bir qator suv havzalari – Qoratog‘, To‘palang, Surxondaryo, Sherobod daryolari, Samarqand viloyati hududidan oqib o‘tuvchi Zarafshon daryosidan tutilgan *Paracobitis longicauda* namunalari asos bo‘lgan (1-rasm). Baliq namunalari tutilishi bilanoq molekulyar tekshirish maqsadida 96% li etil spirt bilan fiksatsiya qilindi. Morfologik tadqiqotlar uchun esa namunalar dastlab 4% li formalin eritmasida fiksatsiya qilinib, baliqlarning hajmiga bog‘liq ravishda 3–7 kundan so‘ng doimiy saqlash uchun 70% li etil spirtiga ko‘chirib o‘tkazildi.



1-rasm. *Paracobitis longicauda*, Surxondaryo havzasi. 24.03.2023 [© Jörg Freyhof].

Tadqiqotning molekulyar tekshiruv qismi Janubiy-g‘arbiy universitet (Chongqing, Xitoy)ning ixtiologiya laboratoriyasida amalga oshirildi. DNK ekstraksiyasi baliqning muskul to‘qimasidan erituvchi K-proteinaza qo‘llagan holda standart fenol-xloroform uslubida amalga oshirildi. Mitoxondrial sitoxrom oksidaza I (COI) genining PZR amplifikatsiyasi uchun Ivanova va hammualliflari [15] tomonidan taklif qilingan VF2_t1 5′-TGT AAA ACG ACG GCC AGT CAA CCA ACC ACA AAG ACA TTG GCA C-3′ va FR1d_t1 5′-CAG GAA ACA GCT ATG ACA CCT CAG GGT GTC CGA ARA AYC ARA A-3′ praymerlaridan foydalanildi.

PZR mahsulotlari 10 ng DNK namunasi, har bir praymerdan 1 µl, 12,5 µl Taq Master Mix (Novoprotein, Guangdong, Xitoy) va ddH_2O dan iborat, jami 25 µl ni tashkil etdi. PZR dagi termal siklik jarayonlar ketma-ketligi quyidagicha bo‘ldi: dastlab 3 min. 94°C; shundan so‘ng jami 35 siklda 20 sek. 94°C denaturatsiya, 45 sek. 54°C va 70 sek. 72°C elongatsiya hamda yakuni jarayon 7 min. 72°C davom etdi. PZR yakunidagi natijalar sekvenslash uchun TsingKe Biological Technology Co., Ltd. (Chongqing, Xitoy) ga yuborildi. Filogenetik daraxtni shakllantirish jarayonida bevosita tadqiqotda olingan COI geni nukleotidlar ketma-ketligi bilan birgalikda NCBI xalqaro bazasida saqlanuvchi boshqa *Paracobitis* turlarining gen ma’lumotlaridan ham foydalanildi (1-jadval). *Sasanidus kermanshahensis* (KU928261), *Eidinemacheilus smithi* (KX461958), *Paraschistura kessleri* (MK238777) va *Oxynoemacheilus persa* (KP050538) tashqi guruh (outgroup) sifatida tanlandi.

1-jadval

NCBI dan yuklab olingan *Paracobitis* turlarining COI nukleotidlar ketma-ketligi ro‘yxati

№	Tur nomi	Havza nomi	Mamlakat	GenBank ID
1.	*Paracobitis abrishamchianorum*	Babol	Eron	MK238771
2.	*Paracobitis abrishamchianorum*	Kashpal	Eron	MK238772
3.	*Paracobitis abrishamchianorum*	Tajan	Eron	MK238773
4.	*Paracobitis abrishamchianorum*	Tajan	Eron	MK238774
5.	*Paracobitis abrishamchianorum*	Babol	Eron	MK238770
6.	*Paracobitis atrakensis*	Atrak	Eron	MK238762
7.	*Paracobitis atrakensis*	Atrak	Eron	MK238763
8.	*Paracobitis hircanica*	Gorgan	Eron	MK238764
9.	*Paracobitis hircanica*	Gorgan	Eron	MK238765
10.	*Paracobitis longicauda*	Topalang	O‘zbekiston	MW649570
11.	*Paracobitis longicauda*	Topalang	O‘zbekiston	MW649571
12.	*Paracobitis longicauda*	Surxondaryo	O‘zbekiston	MW649574

13.	*Paracobitis longicauda*	Sherobod	O‘zbekiston	MW649585
14.	*Paracobitis longicauda*	Sherobod	O‘zbekiston	MW649586
15.	*Paracobitis longicauda*	Zarafshon	O‘zbekiston	MW649587
16.	*Paracobitis longicauda*	Qoratog‘	O‘zbekiston	MW649580
17.	*Paracobitis longicauda*	Qoratog‘	O‘zbekiston	MW649581
18.	*Paracobitis longicauda*	Qoratog‘	O‘zbekiston	MW649582
19.	*Paracobitis malapterura*	Namak	Eron	KJ723499
20.	*Paracobitis malapterura*	Namak	Eron	KJ723512
21.	*Paracobitis malapterura*	Namak	Eron	KJ723511
22.	*Paracobitis malapterura*	Namak	Eron	KJ723505
23.	*Paracobitis malapterura*	Namak	Eron	KJ723515
24.	*Paracobitis malapterura*	Namak	Eron	KJ723502
25.	*Paracobitis molavii*	Sirvan-Dajla	Iroq	KJ723494
26.	*Paracobitis molavii*	Sirvan-Dajla	Iroq	KJ723516
27.	*Paracobitis molavii*	Sirvan-Dajla	Iroq	KJ723506
28.	*Paracobitis molavii*	Sirvan-Dajla	Iroq	KJ723507
29.	*Paracobitis persa*	Kur	Eron	KJ723504
30.	*Paracobitis persa*	Kur	Eron	KJ723509
31.	*Paracobitis rhadinaea*	Chah-Nimeh	Eron	MK238766
32.	*Paracobitis rhadinaea*	Sistan	Eron	MK238768
33.	*Paracobitis rhadinaea*	Sistan	Eron	MK238769
34.	*Paracobitis rhadinaea*	Helmand	Eron	MK238767
35.	*Paracobitis salihae*	Göksu	Turkiya	MT651606
36.	*Paracobitis starostini*	-	Turkmaniston	ON997078
37.	*Paracobitis zabgawraensis*	Dajla	Turkiya	MK238776
38.	*Paracobitis zabgawraensis*	GreaterZab-Dajla	Iroq	MK238775
39.	*Paracobitis zabgawraensis*	GreaterZab-Dajla	Iroq	KJ723514
40.	*Paracobitis zabgawraensis*	GreaterZab-Dajla	Iroq	KJ723497

Jamlangan COI geni nukleotidlar ketma-ketligi Clastal_W algoritmi asosida MEGA7 [16] dasturida tekislandi. Tekislangan nukleotidlar ketma-ketligidagi kamchiliklar SeaView dasturida tahrirlandi. Turlarning o‘zaro genetik masofasi – Kimura-2-Parameter (K2P) ko‘rsatkichi MEGA7 dasturi orqali hisoblandi. Filogenetik daraxt qurish uchun “Qo‘shni turlarni qo‘shish” (Neighbor joining [NJ]) metodidan foydalanildi. NJ usulidagi filogenetik daraxt qurish MEGA7 dasturida amalga oshirildi. Filogenetik daraxt qurishda ham ‘Kimura-2-parameter‘ modeli qo‘llanildi. Yaratilgan filogenetik daraxtlar MS PowerPoint 2019 dasturi yordamida tahrirlandi.

NATIJALAR VA MUHOKAMA

Filogenetik tahlil doirasida *Paracobitis* urug‘i 13 turining 11 tasi qamrab olindi (2-rasm). Umumiy holatda turlar ikki kladadan joy oldi. Birinchi klada o‘z ichiga *P. atrakensis*, *P. hircanica* va *P. rhadinaea* ni olgan bo‘lsa, ikkinchi kladadan qolgan *Paracobitis* turlari joy oldi. *Paracobitis starostini* ikkinchi kladaning asos turi hisoblanib, undan keyingi turlar o‘z navbatida yana ikki kichik kladalarga bo‘linishi ma’lum bo‘ldi. Birinchi kichik kladaga – *P. longicauda*, *P. salihae* va *P. zabgawraensis*; ikkinchi kichik kladaga – *P. abrishamchianorum*, *P. malapterura*, *P. molavii* va *P. persa* kirdi (2-rasm).

Turlar orasidagi genetik masofa (K2P) 3,4% dan 13,0% gacha bo‘lgan ko‘rsatkichni namoyon qildi (2-jadval). Filogenetik tahlil jarayoniga qamrab olingan barcha *Paracobitis* turlarida turlararo genetik masofa boshqa ixtiologik tadqiqotlarda qayd etilgan va ko‘pchilik tadqiqotchilar tomonidan e’tirof etiladigan 2% li chegaradan balandligi ma’lum bo‘ldi [17].

2-jadval

***Paracobitis* urug‘iga mansub 11 yalangbaliq turining o‘zaro o‘rtacha K2P genetik masofasi**

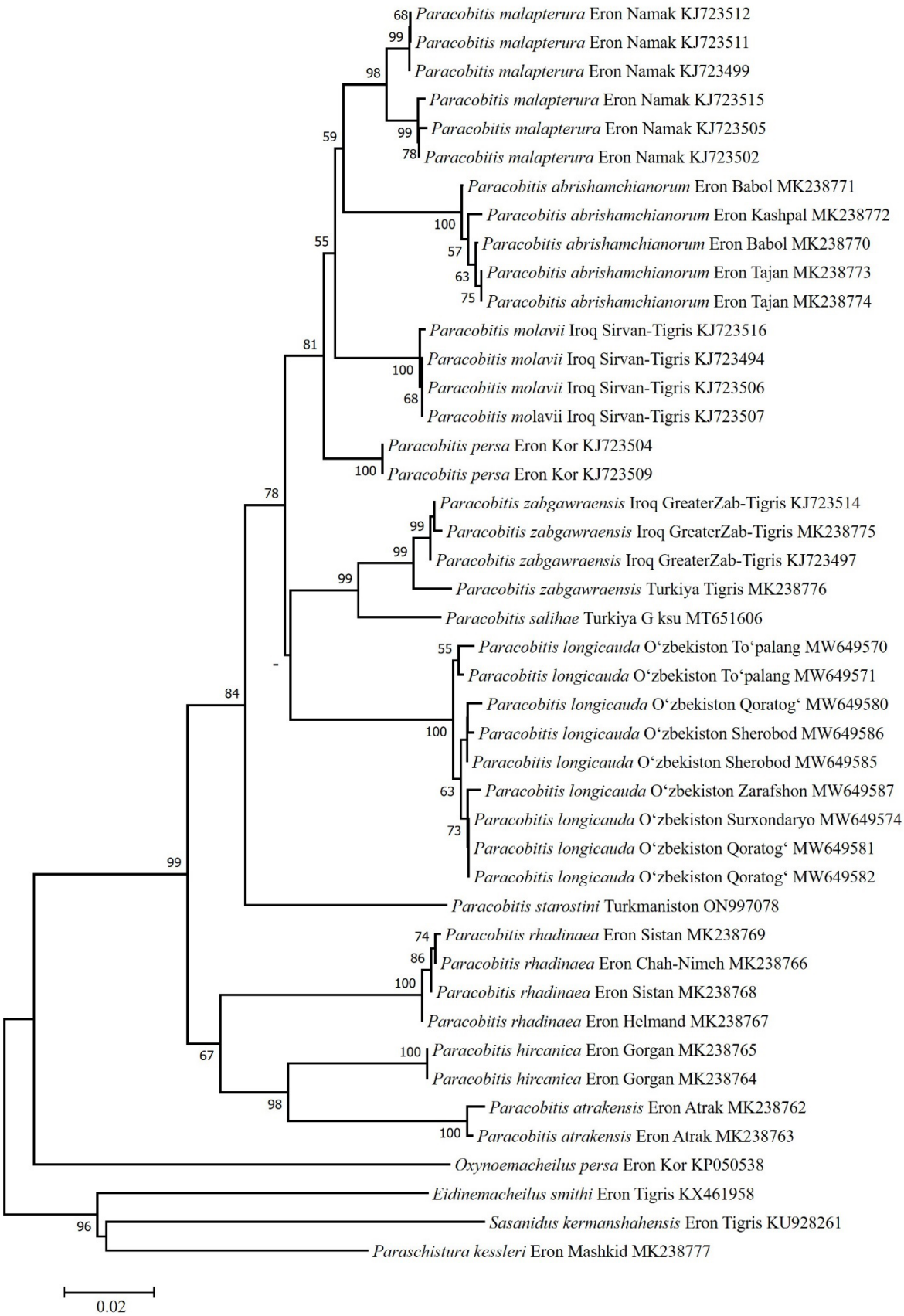
		1	2	3	4	5	6	7	8	9	10
1	*P. abrishamchianoru*m										
2	*P. atrakensis*	0,125									
3	*P. hircanica*	0,106	0,074								
4	*P. longicauda*	0,082	0,117	0,112							
5	*P. malapterura*	0,046	0,124	0,109	0,073						
6	*P. molavii*	0,052	0,115	0,106	0,067	0,037					
7	*P. persa*	0,050	0,111	0,101	0,062	0,034	0,036				
8	*P. rhadinaea*	0,109	0,105	0,091	0,104	0,118	0,112	0,104			
9	*P. salihae*	0,079	0,130	0,103	0,075	0,064	0,061	0,062	0,094		
10	*P. starostini*	0,097	0,112	0,110	0,105	0,080	0,091	0,072	0,109	0,099	
11	*P. zabgawraensis*	0,075	0,126	0,115	0,072	0,065	0,065	0,049	0,100	0,036	0,089

Eng kichik genetik masofa *P. persa* hamda *P. malapterura* orasida kuzatilib, 3,4% ga teng bo‘lgan bo‘lsa, eng yirik genetik masofa *P. salihae* va *P. atrakensis* orasida kuzatildi va u 13,0% ga teng bo‘ldi. *Paracobitis longicauda* uchun genetik jihatdan eng yaqin tur Eronning Kur daryosi havzasida tarqalgan *P. persa* bo‘lib, ular orasidagi K2P ko‘rsatkich 6,2% ga teng. Biroq bunday yaqinlik filogenetik daraxtdagi mazkur ikki turning joylashuvida o‘z aksini topmadi. Genetik jihatdan eng uzoq tur esa *P. atrakensis* bo‘ldi, ular orasidagi K2P masofa 11,7% ga yetdi. *Paracobitis* urug‘ining boshqa turlari bilan esa 6,7–11,2% oraliqda genetik farqlanishni namoyon qildi.

Geografik jihatdan *P. longicauda* ga eng yaqin tur *P. starostini* hisoblanadi. *Paracobitis longicauda* Amudaryo havzasida uchrasa, *P. starostini* Turkmanistonda Amudaryo o‘zanidan 30 km shimol tomonda Xo‘jaqishloq yaqinidagi Suvlio‘yiq ochiq g‘oridagina qayd etilgan. Mazkur ikki tur orasidagi genetik masofa 10,5% ni tashkil qildi. Bu holat Markaziy Osiyoda Nemacheilidae oilasi vakillarining turli yo‘nalishlarda evolyutsiyalanganligini bildiradi. *Paracobitis starostini* asl holatda alohida monotipik urug‘da (*Troglocobitis*) kashf etilgan bo‘lib, yaqinda o‘tkazilgan molekulyar-genetik tekshiruvlar natijasida *Paracobitis* urug‘iga mansub ekanligi aniqlandi [18].

Bizning filogenetik tahlilimiz natijalari ko‘p jihatdan bizdan avvalgi tadqiqot natijalariga to‘la mos keladi. Jumladan, *P. atrakensis*, *P. hircanica* va *P. rhadinaea* larning bir kladada joylashishi, shu bilan birga, urug‘ vakillari filogenetik shajara daraxtining asosida joylashuvi bir qator tadqiqotchilarning tahlillariga muvofiq tushdi [19, 20]. Biroq boshqa tomondan Freyhof va hammualliflari (2022) yalangbaliqlarning ko‘plab urug‘lari ishtirokida o‘tkazgan filogenetik tekshiruv natijalarida *P. starostini Paracobitis* urug‘ining asos qismidan joy olgan edi [18]. Bizning filogenetik tahlilimiz natijalari esa farqli tarzda *P. starostini* ni ikkinchi klada asosida joylashuvini ko‘rsatdi.

Ayni vaqtgacha Orol dengizi havzasi hududidagi *Paracobitis* urug‘i vakiliga bag‘ishlangan tadqiqot ishlarida havzada urug‘ning faqat bir turi qayd etilgani haqida yozilgan. Biroq, Freyhof va hammualliflari (2014) K.Kessler Samarqand viloyati hududidan o‘qib o‘tuvchi Oqdaryodan (Zarafshon daryosi Samarqand viloyati hududiga kirgandan so‘ng ikkiga – Oqdaryo va Qoradaryoga bo‘linib oqadi, Navoiy viloyati Yangirabod shaharchasining pastki qismida yana birlashadi) hamda L.Berg tomonidan Turkmaniston hududidagi Tajan daryosidan va Amudaryoning yuqori oqimidan qayd etilgan *P. longicauda* ning dum suzgich qanotining shakliga e’tibor qaratadi [4]. Har ikki tadqiqotchi tomonidan turning dumi kesik (truncate) ekanligi tasvirlangan. Lekin F.Turdakov tomonidan Oqdaryo daryosidan tutilgan va ayni vaqtda Moskva davlat universitetining Zoologiya muzeyida ZMMU P-3790 raqami ostida saqlanuvchi *P. longicauda* ning ikki namunasida dum suzgich qanotining shakli chuqur o‘yiq (emarginate), hatto deyarli ayri (forked) ekanligi ta’kidlanadi [4]. Mazkur holat “Orol dengizi havzasidagi *Paracobitis* urug‘i vakillari orasidagi geografik yoki ekologik farqlanish natijasimi yoxud bir ilmiy nom



2-rasm. *Paracobitis longicauda* va 10 *Paracobitis* turining NJ metodi asosida yaratilgan filogenetik shajara daraxti.

ostidagi ikki mustaqil turmi?" degan haqli savolni yuzaga keltiradi. Hozirgacha biz tomonimizdan mitoxondrial COI geniga asoslanib olib borilgan tadqiqotlarda Zarafshon va Amudaryo havzasidan qayd etilgan *P. longicauda* populyatsiyalari genetik jihatdan turlararo darajadagi (>2%) farqni namoyon qilmadi [10]. Lekin, shunday bo'lsa-da, rang, dum suzgich qanotining shakli hamda tanasining tuzilishi borasida farqlar qayd etilgan. Mazkur holatga aniqlik kiritish uchun Zarafshon havzasi, Surxondaryo viloyatidagi Amudaryoning turli irmoqlari (Qoratog', To'palang, Surxondaryo va Sherobod), Buxoro viloyatidagi ichki kollektorlar hamda Qoraqalpog'iston hududidagi quyi Amudaryo havzasidan *Paracobitis* namunalarini alohida holatda yig'ib, ularni tez evolyutsiyalanuvchi DNK markerlari (masalan, cytb, CR) orqali genetik-molekulyar jihatdan tekshirish, shu bilan birga chuqur morfometrik hamda morfologik tadqiq etish lozim.

XULOSA

Paracobitis urug'i Markaziy va Kichik Osiyo hududidagi suv havzalarida tarqalgan tur soni unchalik ko'p bo'lmagan yalangbaliqlar bo'lib, Markaziy Osiyo suv havzalarida uchrovchi *P. longicauda* turi o'zining boshqa urug'doshlaridan molekulyar jihatdan ishonarli darajadagi katta farq bilan ajralib turadi (K2P 6,2–11,7%). U Amudaryo, Zarafshon va Tajan daryolari havzasidan qayd etilgan bo'lib, Eron hududidagi suv havzalarida uchrashi tasdiqlanmagan. Orol dengizi havzasidagi *P. longicauda* ning kriptik tur ekanligi borasidagi da'volar tez evolyutsiyalanuvchi DNK markerlari bilan tekshirishni hamda chuqur morfologik tadqiqotlar olib borishni taqozo qiladi.

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TAXONOMIC ANALYSIS OF *PARACOBITIS LONGICAUDA* (KESSLER, 1872), AN ENDEMIC OF THE ARAL SEA BASIN (TELEOSTEI: NEMACHEILIDAE)

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Paracobitis Bleeker, 1863 is one of the unique groups within the Nemacheilidae and is distinguished from other genera by having a dorsal adipose crest. Currently, 13 valid species of the genus *Paracobitis* have been described: *P. abrishamchianorum* (Iran: Tajan, Siah, Talar, Babol, Haraz and Kashpal Rivers, southern Caspian Sea basin), *P. atrakensis* (northeastern Iran: Caspian Sea and Kavir basins), *P. basharensis* (Iran: Tigris River basin), *P. ghazniensis* (Afghanistan), *P. hircanica* (Iran: southern Caspian Sea basin), *P. longicauda* (Middle East and northern-central Asia: Afghanistan, Uzbekistan, Turkmenistan; questionable in Iran), *P. malapterura* (Iran and Iraq: Lake Namak basin and eastern Kavir basin), *P. molavii* (Iran and Iraq: Tigris River basin), *P. persa* (Iran: Kor River basin), *P. rhadinaea* (Iran and Afghanistan: Helmand River, Sistan basin), *P. salihae* (Turkiye: Göksu River drainage), *P. starostini* (Turkmenistan) and *P. zabgawraensis* (Iraq and Turkiye).

Paracobitis longicauda, the only representative of the genus *Paracobitis*, is occured in the Aral Sea basin in Central Asia. This species is mainly distributed in Amu Darya and its many tributaries (Kofirnihan, Tupalang, Karatag, Surkhandarya, Sherabad and Zeravshan rivers). Apart from Uzbekistan, it is known to spread in Afghanistan and Turkmenistan (Tajan and Murgob rivers).

This study was based on the samples of *Paracobitis longicauda* collected from a number of water bodies in the territory of Surkhandarya Region – Karatag, Tupalang, Surkhandarya, Sherabad rivers, Zeravshan River flowing through the territory of Samarkand Region during 2016-2023. DNA was extracted and the COI gene was amplified for molecular study. For analysis, 31 COI sequences encompassing 10 species of *Paracobitis* were added from NCBI to our sequences for a final data set. For phylogenetic reconstructions, the datasets were analysed based on Neighbor Joining (NJ) method in MEGA7.

In the phylogenetic tree, species were placed in two clades. The first clade included *P. atrakensis*, *P. hircanica* and *P. rhadinaea*, while the remaining *Paracobitis* species were included in the second clade. It was found that *P. starostini* was considered the base species of the second clade, and the subsequent species were divided into two subclades in turn. The first subclade includes *P. longicauda*, *P. salihae* and *P. zabgawraensis*; the second subclade included *P. abrishamchianorum*, *P. malapterura*, *P. molavii* and *P. persa*. Genetic distance between species (K2P) ranged from 3.4% to 13.0%.

The closest genetic species to *P. longicauda* was *P. persa* distributed in the Kor basin in Iran, and the K2P distance between them was 6.2%. However, this closeness was not reflected in the location of these two species in the phylogenetic tree. The most genetically distant species was *P. atrakensis*, the K2P distance between them reached 11.7%. And with other species of the genus *Paracobitis*, it showed genetic differentiation in the range of 6.7-11.2%.

To explain the phenomenon of differences between *P. longicauda* populations in the Aral Sea basin, *Paracobitis* specimens from different basins in the region should be collected and molecularly studied using rapidly evolving DNA markers (e.g. cytb, CR) and, in addition, in-depth morphometric and morphological studies are needed.

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