MELANOIDES TUBERCULATA (MÜLLER, 1774) (MOLLUSCA: PROSOBRANCHIA: THIARIDAE): OCCURRENCE AND EXTENSION OF THE GASTROPOD TO KARACHI MANGROVES.

[*]SAFIA KHANAM[1], FAIZA IQBAL[1], QUDDUSI B. KAZMI[2] AND [*]MUHAMMAD UZAIR KHAN[2]

[1]Centre of Excellence in Marine Biology, University of Karachi, Karachi-75270, Pakistan.
[2]Marine Reference Collection and Resource Centre, University of Karachi, Karachi-75270, Pakistan.
**Corresponding author email: safiakh14@hotmail.com; muzairjoji@gmail.com*

خلاصہ

Melanoides tuberculata ایک کائسموپولیٹن میٹھے پانی کے گیسٹروپوڈ ہے جس کا تعلق *Thiaridae* خاندان سے ہے۔اس گیسٹروپوڈ کے موجود ہونے کا کوئی ریکارڈ پاکستان کے estuarine علاقوں میں پہلے کبھی نہیں ملا۔موجودہ مطالعے میں *M. Tuberculata*، مینگرو *Avicennia marina* روسی بیچ (پورٹ قاسم، کراچی) میں وقفے وقفے سے خالی خولوں کے طور پر بڑے پیمانے پر دریافت ہوا ہے۔یہ درمیانے اور اونچے سمندری علاقوں میں زیادہ پائے جاتے ہیں جبکہ اوسطا اونچائی 0.5 میٹر کی اونچائی پر کم سمندری زون میں کم مقدار نسبتا۔مطالعہ کے دوران *M. Tuberculata* کے 158 خالی خول ملے۔

موجودہ مطالعے میں پاکستان کے شمالی بحر عربی سمندر کے *Avicennia marina* میں اس پر جاتی کی وسیع پیمانے پر تقسیم کی دستاویز کی گئی ہے۔جیسا کہ یہ ریکارڈ خالی خولوں پر مبنی ہے، کراچی *mangroves* میں اس میٹھے پانی کے خشکی کی دستیابی کی ممکنہ وجوہات پر تبادلہ خیال کیا گیا ہے۔

Abstract

Melanoides tuberculata is a cosmopolitan freshwater gastropod snail belonging to the family Thiaridae. There has been no record of occurrence of this gastropod in Pakistani estuarine habitats. In the present study, *M. tuberculata* is abundantly discovered as empty shells in the intertidal areas in the mangrove *Avicennia marin*a Russian Beach (Port Qasim, Karachi). They are more abundantly observed in mid and high tidal zones while low quantity in low tidal zone comparatively on an average tidal height of 0.5 meter. A total number of 158 empty shells of *Melanoides tuberculata* were found during study. The current study documents broader distribution of this species in mangrove of *Avicennia marina* of Pakistan (northern Arabian Sea). As this record is based on empty shells, the possible reasons of availability of this fresh water snail in Karachi mangroves is discussed.

Keywords: Distribution, Thiaridae, empty shells, mangroves, *Avicennia marina.*

Introduction

Globally, *Melanoides tuberculata* (Prosobranchia: Thiaridae) is one of the dominant thiarid gastropod that has established its live population in diverse habitats adapted to high salinity variation (Santos and Eskinazi-Sant'Anna, 2010; Silva and Barros, 2015) but predominantly freshwater, found in rivers, springs, streams, lakes, swamps, etc., including artificial environments mangrove swamps (Roessler *et al*., 1977; Wingard *et al*., 2007; Barroso and Matthews-Cascon, 2009). It occasionally invades brackish and marine habitats, since it is a bioinvader specie and can successively survive in ecological adaptations from fresh to eutrophic conditions - an euryoec specie, found from the coast to low-and upland (Starmuhlner, tsniaga tnatsiser yrev si lians ehT.(1974 na noitullop cinagro ,serutarepmet rehgihd also found in slightly brackish waters. Studies have revealed that there is a continuous expansion and distribution of *Melanoides tuberculatus* (Müller, 1774) all over the world in diverse habitats. There is strong evidence that what is referred to as *M. tuberculata* is in fact a species complex (Genner *et al*., 2004, 2007).

From Pakistan, it has been reported by Akhtar (1978) as red-rimmed Melania (common name of *Melanoides tuberculata*), the common name comes from the presence of reddish spots on the otherwise greenish-brown shell (Figure 2). Then Haseeb (1984); Begum and Nazneen (1992); Burdi *et al*., (2008); Afshan *et al*., (2013); Saddozai *et al*., (2013) and Kakar *et al*., (2017) reported it as *Thiara tuberculata* from the provinces of Sindh, Baluchistan, Khyber Pakhtunkhwa and central Punjab, it is also reported from Indian Punjab by Khanna, (1974) but surprisingly not given in recent report from Punjab by Altaf *et al*., (2017) according to later report, gastropods have never been studied in Punjab with reference to their diversity and distribution. Lately, Gondal *et al*., (2020) reported its presence in Rawalpindi, Islamabad hilly areas. The present study has addressed single taxonomic unit native to the sub- continent. It is difficult to resolve the nomenclatural and

taxonomic issues for this species. However, in this study, the occurrence and extension of the gastropod in Karachi mangroves were discussed.

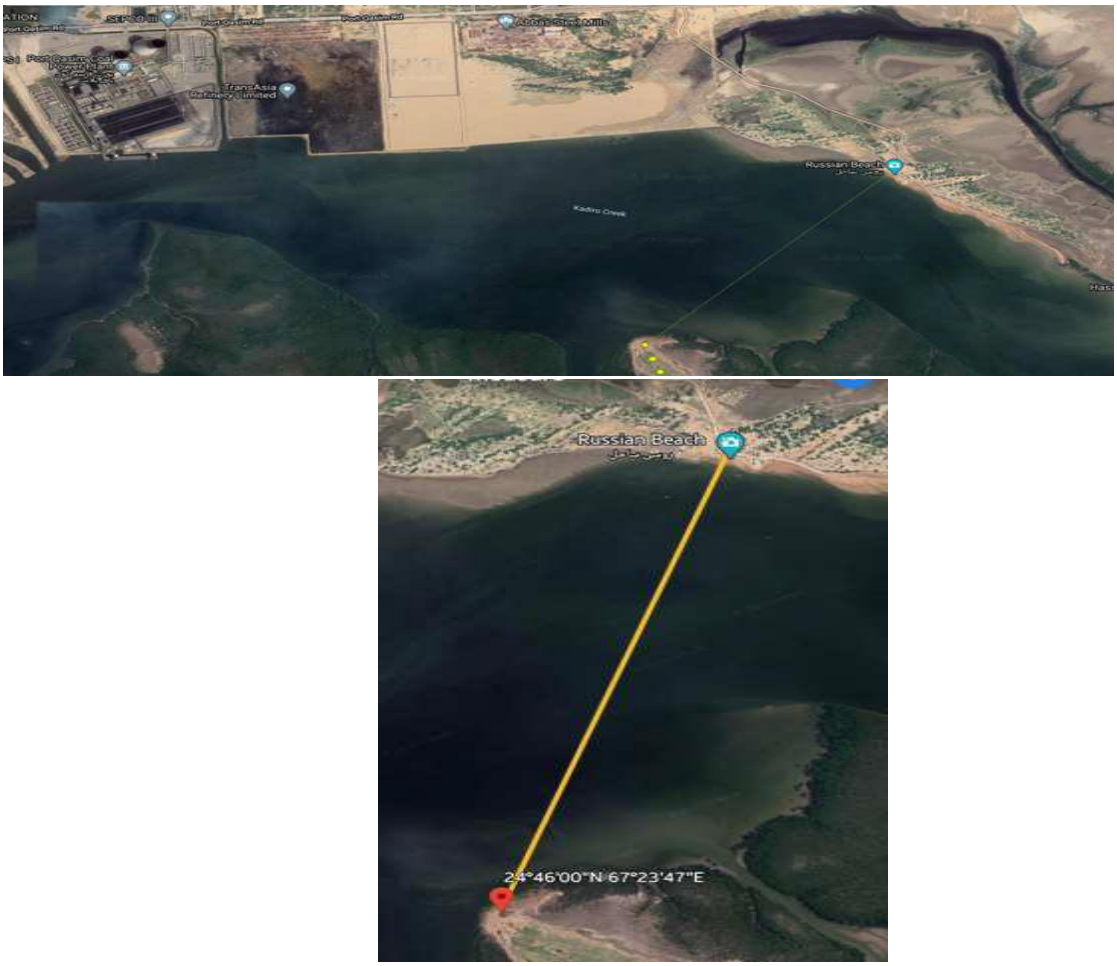

Fig.1 Study site of Russian beach at Port Qasim, Karachi

Fig.2. *Melanoides tuberculata* – Red Rimmed Milania THIARIDAE

Material and Methods

The study was carried out during a macro-benthic faunal study of mangroves at Russian beach, Karachi. Mangroves sediments were collected from the intertidal zones (Figure2) on an average tidal height of 0.5 meter by boat travelling from an area of 1.75 km away from Russian beach (24°46'00" N, 67°23'47" E) in Khadero creek, located at Port Bin Qasim, Karachi. (Fig.1). The area is densely populated with grey mangroves; *Avicennia marina*. All the samples were tagged and brought into the laboratory for further analysis, during sorting of the macrobenthic fauna, empty shells of *M. tuberculata* were also separated.

Regular surveys for macrobenthic samplings of mangrove sediments were made throughout January to June, 2018 for the above mentioned study. Mud samples, were when sieved and analysed for macrobenthic fauna, a great quantity of these empty shells i.e. 158 shells were separated during the data analysis from intertidal zones. Density was higher in high and mid tidal zone. It is surprising that the same study was carried out in Korangi creek, about 49KM away from the first sampling site, but this gastropod was entirely absent throughout the study site. Explorations for live examples in the region have demonstrated unbeneficial however, void shells stayed plentiful. Void shells can't be dependably sex-characterized so, the investigation was not taken in this viewpoint.

Results and Discussion

During study, 158 empty shells were found, description of the shells is given, the shells ranging in size were between 3-5 cm in height and 1-2 mm in width. Conical shell, number of whorls 7, shell light brown in colour, elongate and conical, whorl rounded, convex and gradually increasing in size downward, aperture small and ovate, operculum paucispiral, shell sculptured with reddish markings, vertical weakly curved ribs and much finer spiral striations, light brown to white shell and sand to dark brown markings (Fig. 2).

These empty shells were observed at Port Bin Qasim. Port Bin Qasim is located in an old channel of the Indus River. It is noteworthy that Kadiro creek was formerly known as Kadiro River which was in fact the tributary of River Indus that carried fresh water. At present virtually it is a tidal creek, this tidal creek connects the mangrove with adjacent areas and provide well-defined pathways for aquatic organisms and for water and material exchange. Since the empty freshwater shells float, the dead shells in our area may have reached here through river drift, the accumulations of small floating bits and pieces left behind by creeks and rivers after floods. The number of empty shells registered at the three sites showed significant differences in its composition. The condition of protection of the vacant shells was anon; consequently, no qualifications were made in regard to the condition of preservation of the shells. Empty shells were concentrated in the area near-muddy swamps in all intertidal zones especially at mid and high tidal zones; however intensity is low at low tidal zone.

Shells can be solid or have patterns with colours ranging from brown, grey and creamy-white occurrence of dark red-brown dots either unevenly distributed or arranged longitudinally on the shell. This specie is called the red-rimmed Melania; this name originates as of the occurrence of reddish spots on the greenish-brown shell.
M. tuberculata has invaded several tropical and subtropical aquatic ecosystems in the world (Müller, 1774). Invasive species can have significant direct and indirect impacts on native biota, for example their impact on the shell utilization patterns of intertidal populations of hermit crabs (Van-Oosterhout *et al*., 2013). Although *M. tuberculate* is restricted to freshwater, it is prone to being washed downstream during heavy downpours. Since these gastropods cannot tolerate prolonged exposure to salinities above 25 PSU (Bolaji *et al*., 2011), their mortality results in an influx of empty shells to the marine environment. The thick shell of the gastropod may deteriorate being crushed by predation but they managed to reach mangrove channel in undamaged form. The resistance of *M. tuberculata* shells to attack by crushing predators has been studied by several workers.

The present study provides the information on expansion and propagation of *M. tuberculata* in different systems. Our observations raise cautions about the ecological status of the aquatic biological systems of mangrove, chiefly on the grounds that this district normally has not many sources of freshwater and the nature of the accessible water is restricted. Our observations will provide information on expansion and propagation of *M. tuberculata* in the different systems. Therefore, it is imperative that greater efforts be directed toward monitoring the expansion of *M. tuberculatus* in the aquatic ecosystems of Karachi mangrove zone. A comprehensive study in this regard is necessary to get the complete distribution of the fresh water snail in mangrove habitats of other regions of Karachi coast.

Conclusion

As *M. tuberculata* was recorded first time from Russian beach, Karachi on the basis of void shells. Far reaching concentrated efforts in such manner is important to get better results by exploring other mangrove areas.

Acknowledgement

Acknowledge to CEMB, University of Karachi for financial assistance

References

Afshan, K., Azhar, B. M., Ahmad, I., Ahmad, M. M. and Qayyum, M. (2013). Freshwater Snail Fauna of Pothwar Region, Pakistan. *Pakistan. J. Zool.,* 45 (1): 227-233.

Akhtar, S. (1978). On a collection of freshwater Molluscs from Lahore. *Biologia*., 24: 437-447.

Altaf, J., Qureshi, N.A. and Siddiqui, M.J. I. (2017). Terrestrial snails as bioindicators of environmental degradation. *J. Biodiv. Environ. Sci.*, 10: 253-264.

Barroso, C. X. and Matthews-Cascon, H. (2009). Occurrence of the exotic freshwater snail *Melanoides tuberculatus* (Mollusca: Gastropoda: Thiaridae) in an estuary of north-eastern Brazil. Marine Biodiversity Rec., 2:1-4.

Begum, F. and Nazneen, S. (1992b). Systemic study of Molluscan fauna of Layari River, part 7: Bivalves (Paleoheterodonta). *The Philippine J. Sci*., 121: 121-133.

Bolaji, D. A., Edokpayi, C.A., Samuel, O.B., Akinnigbagbe, R.O. and Ajulo, A. A. (2011). Morphological characteristics and salinity tolerance of Melanoides tuberculata (Muller, 1774). *World J. Biological Research*. 004: 2.

Burdi, G.H., Baloch, W.A., Begum, F., Soomro, A.N. and Khuhawar, M. Y. (2008). Ecological studies on freshwater gastropods (snails) of Indus River and its canals at Kotri barrage Sindh, Pakistan. Sindh, *University Research Journal*. 40 (2): 37-40.

Genner, M. J., Michel, E., Erpenbeck, D., De-Voogd, N., Witte, F. and Pointier, J.P. (2004). Camouflaged invasion of Lake Malawi by an oriental gastropod. *Molecular Ecology*. 13: 2135-2141.

Genner, M.J., Todd, J.A., Michel, E., Erpenbeck, D., Jimoh, A., Joyce, D. A., Piechocki, A. and Pointier, J. P. (2007). Amassing diversity in an ancient lake: evolution of a morphologically diverse parthenogenetic gastropod assemblage in Lake Malawi. *Molecular Ecology*. 16: 517-530.

Gondal, M.A., Waheed, Q., Tariq, S., Haider, W., Khan, A., Rasib, Q. and Ahmed, H. (2020). Morpho-Ecological Study of Freshwater Mollusks of Margalla Foothills, Pakistan. *Pakistan J. Zool*., 52(3): 863-874.

Haseeb, M.A. (1984). Studies on larval trematodes infecting freshwater snails in Pakistan. X. Non-virgulate xiphidiocercariae. *Z. Parasitenkd*. 70: 637–654.

Kakar, S., Kamran, K., Essote, S.A., Iqbal, A. and Ali, M. A.(2017). Species diversity of freshwater snails (Mollusca: Gastropoda) in different sites of Balochistan province of Pakistan.. 10(3): *International Journalof Biosciences* 251-259.

Khanna, A. (1974). Survey of Molluscan Fauna of Punjab. Department of Zoology, PAU, Ludhiana. Checklist Stats Number of Species: 85.

Muller, O. F. (1774). *Vermium terrestrium* et fluviatilium. 2-4: 1-208.

Roessler, M. A., Beardsley, G. L. and Tabb, D. C. (1977). New records of the introduced snail, *Melanoides tuberculata* (Mollusca: Thiaridae) in south Florida. *Florida Scientist*. 40(1): 87-94.

Saddozai, S., Baloch, W. A., Achakzai, W. M. and Memon, N. (2013). Population dynamics and ecology of fresh water gastropods in Manchar lake Sindh, Pakistan. *Journal of Animaland Plant Sciences*. 23(4): 1089-1093.

Santos, C. M. and Eskinazi-Sant'Anna, E. M. (2010). The introduced snail *Melanoides tuberculatus* (Muller, 1774) (Mollusca: Thiaridae) in aquatic ecosystems of the Brazilian Semiarid Northeast (Piranhas-Assu River basin, State of Rio (Grande do Norte). *Brazilian Journalof Biological Revistabrasleira de biologia,* 70(1):1-7.

Silva, E. C. and Barros, F. (2015). Sensibility of the Invasive Snail *Melanoides tuberculate* Sensibility of the Invasive Snail *Melanoides tuberculatus* (Müller, 1774) to salinity variations. (Müller, 1774) *Malacologia*, 58(1–2): 365-369.

Starmühlner, F. (1974). Results of the Austrian-Ceylonese hydrobiological mission 1970. Part XIV: the freshwater gastropods of Ceylon. Bulletin of the Fisheries *Research Station, Sri Lanka* 25 (1-2): 97-150.

Van-Oosterhout, C., Mohammed, R.S., Xavier, R., Stephenson, J., Archard, G. A., Hockley, F., Perkins, S. and Cable, J.(2013). Invasive freshwater snails provide resource for native hermit crabs. *Journal of AquaticInvasions.* 8:185-191.

Wingard, G.L., Murray, J.B., Schill, W. B. and Phillips, E. C. (2007). Red-rimmed melania (Melanoides tuberculatus): a snail in Biscayne National Park, Florida – harmful invader or just a nuisance? *U.S. Geological Survey Fact Sheet*, 2008-3006;