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First record and description of marine flatworm *Pseudoceros susanae* (Newman & Anderson, 1997) from Indian mainland

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Abstract
Pseudoceros susanae belongs to the order Polycladida in the phylum Platyhelminthes, has been reported for the first time from South Saurashtra coast of Gujarat, India. The *Pseudoceros susanae* found distributed to coastal areas like, the Chhara, Mul Dwarka, Dhamlej, Sutrapada, and Veraval coasts. Identification was mostly based on external morphological characteristics, with a particular on their live colors and patterns. This work reveals that polyclads are significantly different in Gujarat, as well as require for more research using both morphological and genetic information to identify their identities.

Keywords: flatworm, polycladida, *Pseudoceros*, Saurashtra coast

Introduction

The coastline of Gujarat is longest among Indian states, extending up to 1650 km, constituting about 21% of the Indian coastline (Parikh *et al*. 2019) [16]. The Saurashtra coast is a part of the coastal Kathiawar Peninsula of the Indian subcontinent, located in the southwestern region of Gujarat State (India), and stretches over 865 kilometers. The South Saurashtra coastline from Dwarka to Diu is approximately 300 kilometers long, featuring rocky-sandy and rocky-muddy intertidal zones. This coastline of intertidal zone is defined by structural changes in substratum such as bare rocky areas, areas with algal cover, uneven rocky areas with more pools and fissures, and so on. These environments all have their own assemblage structure (Branch, 1986). Turbellaria is a class of free-living benthic organisms found in both marine and freshwater settings. Polyclads are marine turbellarians, except for the genera Limnostylochus and Limnoplana, all polyclads are marine that belong to the phylum Platyhelminthes, clade Rhabditophora, order Polycladida, which consists of wide flattened forms that are generally smooth, free-living, entirely marine, and usually bottom dwellers (sometimes swimming). Their ciliary motion causes them to glide along the substratum. Because this carnivorous unsegmented flatworm lacks a skeletal structure, it is soft and flexible, allowing it to access nearly all cracks and crevices in the reef (Ehlers, 1986) [4]. Although they have been observed in temperate and deep-sea conditions, they are the most colourful and elegant species found in tropical shallow water and intertidal regions (Quiroga, Bolanos and Litvaitis 2006; Faubel 1983) [20, 5]. Anatomically, these polyclads have a branching and uneven stomach, as well as a plicatus a pharynx. Traditional classifications primarily put taxa with minimal phylogenetic inference in the order Polycladida, which has around 800 identified species (Tyler *et al*., 2006–2018) [21]. Polyclade research have been ignored in India, and little is known about their variety on the east and west coastlines. Earlier research on polyclad worms was done by (Lang (1884) [14], Woodworth (1898) [22], Haswell (1907) [6], Yeri and Kaburaki (1918) [23] and Bresslau (1933)). Marcus (1950) [15], Hyman (1939, 1954a&b, 1955, 1959) [7, 8, 9, 10] and Prudhoe (1985, 1989) [18, 19] also significantly contributed to the taxonomy of polyclads. A few recent investigations, mostly from the coral reefs of Lakshadweep Island, India, have reported this species (Deepak and Reshma, 2011).

The present study report *Pseudoceros susanae* for the first time from the Saurashtra coastline, Gujarat state. Photographs of live specimens were recorded in the field to capture the true colors. The color patterns are described using living specimens. Identification is only based on exterior morphology and color patterns, with the assistance of the aforementioned literature and web sources.

Methodology

The specimens were observed on rocky littoral zone of Chhara (20°44'38.53"N, 70°43'22.06"E), Mul Dwarka (20°46'8.04"N, 70°39'58.65"E), Dhamlej (20°46'38.58"N, 70°36'36.89"E), Sutrapada (20°50'17"N, 70°29'14"E) and Veraval (20°54'36"N, 70°20'23"E) coast of Gujarat (Fig. 1). Identification was confirmed by Photographic evidence, luminous blue body, sometime degraded from white and going to the margin bright orange median

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Deciphering the Taxonomy, Phylogeny and Distribution of the Marine Polychaete *Eulalia viridis* (Linnaeus 1767) from Saurashtra Coast, Gujarat, India

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ABSTRACT

Phyllodocidae is one of the diverse families of class Polychaeta. The worms of this family generally live in intertidal habitats such as algal beds, rock crevices, mudflats also in the deep sea and some of the members are pelagic. *Eulalia viridis*, is a Marine Polychaeta and was observed along several coastal regions of Saurashtra. In this paper, a taxonomic and distributional description of *Eulalia viridis* (Linnaeus 1767) is undertaken along with its DNA Barcoding. This approach gave us broad spectra to understand its Morphology and Phylogeny. The study was conducted along different coastal stations such as Okha, Dwarka, Mangrol, Veraval, Sutrapada and Chhara. The samples were collected for Morphological study as well as DNA Barcoding. The COI region was amplified using specific primer for DNA Barcoding of *Eulalia viridis*. The phylogenetic tree was prepared for the confirmation of obtained species. The study revealed the distribution and abundance of *Eulalia viridis* along the Saurashtra coastline. The present study is the first to provide DNA Barcoding of *Eulalia viridis* from India.

Keywords Phyllodocidae, Taxonomy, Morphology, Distribution, DNA Barcoding.

INTRODUCTION

Polychaeta is one of the class of phylum Annelida often stumble across the marine environment, although some species are present in freshwater and rare are known from moist soil on land. Polychaetes are multi-segmented worms with huge morphological diversity, brightly colored, and have sizes ranging from less than 1 mm to several meters in length (Bartolomaeus *et al*. 2005, Garrison 2007, Eklöf 2010). Dales (1962), for instance, even differentiated several Polychaeta families based on structural variations of the proboscis (also called 'trunk' or 'eversible pharynx'), which shows radiated adaptation to multiple feeding

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PRELIMINARY SURVEY OF TIDEPOOL DIVERSITY FROM VERAVAL COAST, GUJARAT, INDIA

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Abstract

In the present study, rocky coast of Veraval was surveyed extensively from ecological and biological point of view for their coast characteristic like tidal exposure, assemblage structure, microhabitat and their fauna. Based on the preliminary surveys, tidepools were classified on the basis of their length–depth ratio (LRD) because the pool depth, length, orientation and their macro fauna/flora make individual pool unique. A total 17 tidepools were observed at the coast. The presence and absence of faunal groups at particular zonation make each pool unique ecosystem and community. The observations revealed that the diversity of flora and fauna were unique as upper littoral zone was showing variation (presence of *Echinolittorina malaccana, Cellana karachiensis)* in diversity compare to middle (*Echinometra Sp., Hermodice carunculata*) and lower littoral (*Pilumnus vespertilio*) zones. This may be due to the coast characteristics and structural variations of the tidepools, floral diversity, substratum type, microhabitat and other coastal habitats. After this we selected two tide pools to study the role of mobile and sedentary organism in structuring macro faunal communities of rocky tide pool. Different species of the various phyla were observed in the tide pool and prepare a baseline database of the diversity of macro fauna and flora present in tide pool. This study also revealed that tide pools are important refuge from the extreme environmental fluctuation between the sub tidal and the emergent substrata of rocky intertidal habitats.

Keywords: *Tidepool, Communities, Microhabitat, Diversity, Intertidal Ecosystem*

Introduction

Tidepools are the window into marine ecosystems which allow people to observe a live show of the community interactions in the ecosystems for recreational and educational purposes (Pinn and Rodgers 2005; Davenport and Davenport 2006; Addison et al., 2008; Martens, 2015; Wyles et al., 2017). Tidepools normally contain diverse communities of smaller organisms, and are often conspicuous by not having charismatic species and often not comparable to many other ecosystems like grasslands, uplands etc. (Jefferson et al., 2014, Goodwin and Leader Williams, 2000). Tidepools are highly variable in time (i.e. tidal, seasonal and diurnal) and space (from geographic to local scale) and in few cases can be extremely productive microhabitat. These are isolated, having patchy distribution along the rocky shoreline. (Martins et al., 2007). Combination of physical factors of pool such as location in intertidal height, topography, depth, volume and wave exposure are unique to each pool (Metaxas and Scheibling; 1993). Functional traits, phyla and diversity of animal species drove human interest in tidepools communities as entertainment, hobby and education (Fairchild et al., 2018). In many parts of the world, intertidal rock pools containing rich biodiversity with many co-occurring species, different phyla and individuals of sub tidal species, provide a shelter for this biota. (Jernakoff and Underwood, 1984; Moran, 1985; Fairweather, 1988; Phillips, 2001; Firth, 2014). Biotic communities of emergent substrata are highly studied than tidepools of rocky intertidal environments. (Underwood and Skilleter, 1996). For the study of top – down and bottom – up control factors, tidepools are provide a novel setting along the rocky shores. (Methratta, 2004). Along the intertidal zone rock pools are highly variable in space and time and they contain diverse community of plant, invertebrates and fish life. (Firth et al., 2013). Biological factors regulate the structure and compositions of rock pools assemblage, these factors are such as, availability of the shelter, presence of food resources and predators combined with physical and physicochemical factors of pools such as temperature, salinity oxygen content, depth and volume of pool and position of rock platform.

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