

Digitization of the Data on Indian Freshwater Crabs: 1 *Travancoriana Schirnerae* Bott, 1969 (Decapoda: Gecarcinucidae)

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Abstract

This resent research article is on the digitized form of valuable data on freshwater crab, Travancoriana schirnerae Bott, 1969. The data acquired from various sources, such as, internet articles, published research articles and databases about the species has been organized in the form of a web portal open for access for a wider audience. The data collected are categorized into 15 user friendly heads such as, Species name, Anatomy, Life Cycle, Moulting, Spawning, Diseases, Fossils, Fisheries and Industries, Nutritive value, Internet links, Books and resources, Barcoding, General Biology, References of resources and General Aspects, under the title named resources. Digitization will ensure to provide background information to all those are interested to continue further in research in this area and this forms the major objective of the paper.

Key-words: *Travancoriana Schirnerae*, Gecarcinucidae, Data Digitization, Storage and Retrieval, Freshwater Crab.

1. Introduction

Crabs belong to the order Decapoda. The body is divided into cephalothorax and abdomen. The cephalothorax is broad and covered by chitinous exoskeleton – the carapace. The abdomen is highly reduced and flexed and kept under the sternum. The cephalo-thoracic regions bear 13 paired appendages, namely, antennules, antennae, mandibles, maxillulae, maxillae, first maxillipeds, second maxillipeds, third maxillipeds, 1 st to 5 th pereopods and abnominal appendages. Carapace is highly

expanded. It is one of the important taxonomic characters. Its structure is peculiar for a particular taxon. The abdomen is generally sexually dimorphic: narrow in males and broader in females.

Several regions on the surface of carapace can be identified. They are frontal (fr), orbital (orb), protogastric (pg), hepatic (Hep), mesogastric (mg), metagastric (mtg), urogastric (ug), cardiac (crd), intestinal (int), epibranchial region (Eb), mesobranchial (mb) and metabranchial (mtb). The shape of carapace varies with taxa: transversely ovate; transversely hexagonal; hexagonal; pentagonal; pyriform; circular; sub-circular; transversely subovate; triangular; longitudinally ovate; squarish; longitudinally rectangular; trapezoidal; transversely rectangular.

The number of extant species of fresh water crabs in the world are around 1400 (World Register of Marine Species: <http://www.marinespecies.org/aphia.php?p=taxdetails&id=106673>). They inhabit different ecological niches including trees. Serious studies on taxonomy, eco-biology of different species are available and considering the vast assemblage of data and varied habitat preferences, consolidation of biological data on different species has become highly complicated. For easy storage and retrieval of data digitized methods are highly recommended and an initiation of digitization of data on crabs has been done here. The present paper deals with the digitization of one species of freshwater crab, namely, *Travancoriana schirnerae* Bott, 1969 from India. The authors presume that digitization will be easy and user friendly, if appropriate data storage and retrieval system is developed that will enable the biologists and others who are interested to utilize for further research and management of the resources. Such interdisciplinary research work is the need of the hour.

2. Experimental

Data was collected from various sources such as from web portals, Internet articles, published research articles and reports, available databases (doi.org, marinespecies.org, crabdatabase.info, indiabiodiversity.org, wikipedia.org, ncbi.nlm.nih.gov, archive.org, etc.) and the same has been made use of in the present publication. As an user friendly approach the data collected based on the references (Pati and Thackeray, 2018; Bott, 1969; Bahir and Yeo, 2007; Rajesh et al., 2017; Raghavan and Moorkoth, 2014a; Gopal and Raghavan, 2019; Raghavan and Moorkoth, 2013b; Raghavan et al., 2015; Raghavan and Moorkoth, 2015a; Raghavan and Moorkoth, 2015b; Raghavan and Moorkoth, 2013a; Pati and Thackeray 2018; doi.org, marinespecies.org, crabdatabase.info, indiabiodiversity.org, wikipedia.org, ncbi.nlm.nih.gov, archive.org) on the species has been categorized under 15 heads, namely, Species name, Anatomy, Life Cycle, Moulting, Spawning,

Diseases, Fossils, Fisheries and Industries, Nutritive value, Internet links, Books and resources, Barcoding, General Biology, References of resources and General Aspect. The programme of digitization and presentation of digitized data are depicted below.

3. Results and Discussion

Classification for the species is: Infraorder- Brachyura Latreille, 1802; Section- Eubrachyura Saint Laurent, 1980; Subsection- Heterotremata Guinot, 1977; Superfamily- Gecarcinucoidea Rathbun, 1904; Family- Gecarcinucidae Rathbun, 1904 (Latreille, 1802; Saint Laurent, 1980; Guinot, 1977; Rathbun, 1904).

We do have significant web portals such as doi.org which furnishes Digital Object Identifier (DOI) services along with registration (doi.org). Marinespecies.org website supplies an authoritative and comprehensive list of names of the marine organisms. This marinespecies.org website provides the valid names of the species along with the other names that are in use, hence making this website a register which could serve as guide to interpret the taxonomic literature (marinespecies.org). Crabdatabase.info website serves as the database where we can find the crab species along with beautiful pictures of the species as proofs; it also provides taxonomic position of the species along with the Synonym (crabdatabase.info). In the indiabiodiversity.org website we can find the species with accepted name, along with the classifications. We can also get the occurrence record of the species (indiabiodiversity.org). The ncbi.nlm.nih.gov, the national center for biotechnology information advances science and health website provides access to biomedical and genomic information (ncbi.nlm.nih.gov). Archive.org, the internet archive website is a digital library where we could find the oldest artifacts in digital form (archive.org).

In our work we collected all essential information about the freshwater crab *Travancoriana schirnerae* Bott, 1969 from various available sources and bring them under one database. A digitized form as a web portal for everyone to access.

The data collected are categorized into 15 user friendly topics as resources, namely, Species name, Anatomy, Life Cycle, Moulting, Spawning, Diseases, Fossils, Fisheries and Industries, Nutritive value, Internet links, Books and resources, Barcoding, General Biology, References of resources and General Aspects. Also the web portal will provide the taxonomy, diagnosis and publications of the species.

3.1. Working Principle of Digitization of Data

This section provides the design of web portal to store the information about the Indian Freshwater crab, *Travancoriana schirnerae* Bott, 1969. The data collected under 15 heads mentioned above are shown as screen shots to explain how the digitization progresses. This paper provides the design of the two main web pages of the web portal, namely, “Species Detailed page” and “Resource detailed page”, say, for the species *Travancoriana schirnerae* Bott, 1969. The “Species Detailed page” will provide the image of the species along with Diagnosis. We can also find the Taxonomy of the species, 15 resources list and publications done on the species. Along with a space to leave comment. In “Resource detailed page”, we can find the information provided under each resource respectively.

1. New User Registration Process

New user clicks on the Register link in the login page. Fill all fields with the correct information, namely- Email ID, Password, Confirm Password, Mobile, and Qualification and clicks on the Register button in the New Registration popup. An acknowledgment message is displayed if registration is perfectly done - "Successfully Registered". Provision for change of password is also provided. The user once registered can login to the web portal.

2. Login Process

Login can be done by using the registered Email ID and password.

3. Searching for the Species

Once logged in the user will be directed to the search page. The search page gives a list of species from which desired species, here, "*Travancoriana schirnerae* Bott, 1969" can be searched by entering the search key, here "*Travancoriana schirnerae* Bott, 1969" and click on “Search” icon or choose the search value from the filter and click on “Go” button.

4. Search Result

The Thumbnail of the species will be displayed in the “Result” section. It contains few words about diagnostic characters of the species and can further be navigated in the “Read more” option, where the user can access the full information about the species.

5. Navigation to the Species Detailed Page

Click on the “Read more” button in the thumbnail, will direct to the “Species detailed” page with the following related information. Visit to desired information on the following aspect is choice based and by clicking on each section the following details will be available.

- a. Photo gallery
- b. Taxonomy
- c. Resources
- d. Diagnostic Characteristics
- e. Publications
 - a) Click on the option "Photo Gallery" to view the available images of the species (from various sources with acknowledgement)
 - b) "Taxonomy" section provides the descriptive taxonomy of the species for identification purpose.
 - c) "Resources" section is vast and is categorized into 15 heads already mentioned, will appear as hyperlinks. Again choice based and navigates to each resource.
 - d) "Diagnostic characteristics" section will provide diagnosis of the species.
 - e) Publications accommodate publications about the species.

6. Leave a comment

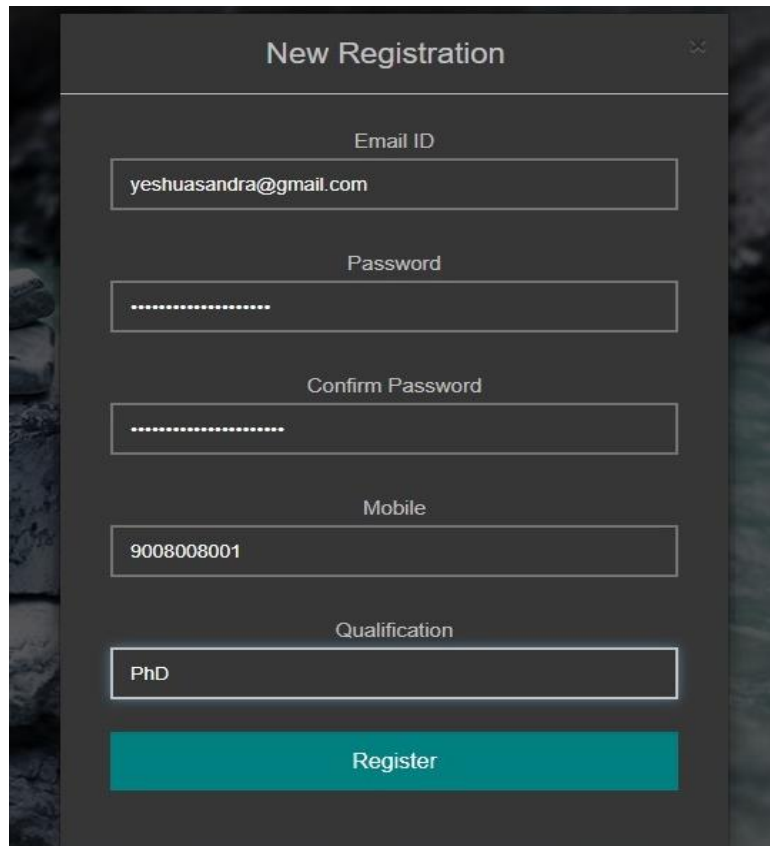
The user can leave his/her comment here for improvement. Also encourage to provide additional information for inclusion in the content about the species.

7. Logout Process

The user exits through "Logout" button.

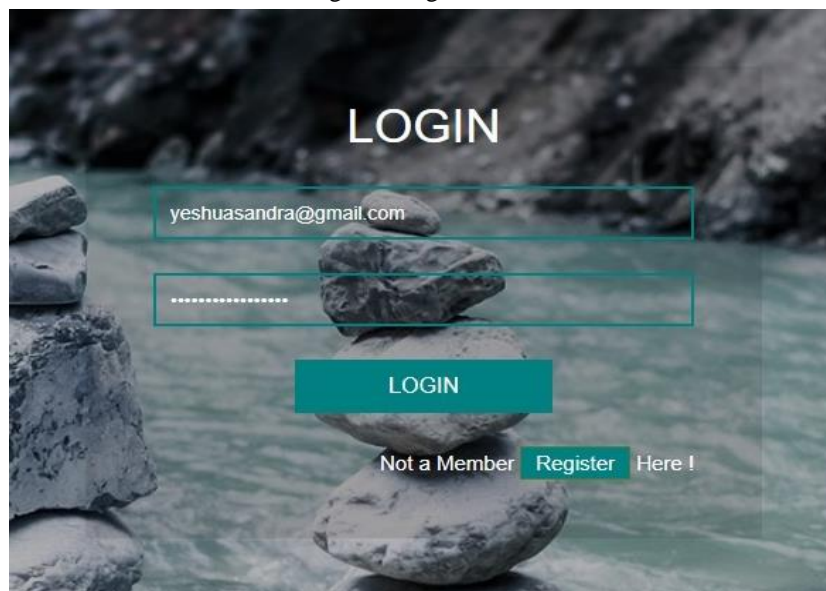
For making the process more clear, images of the prototypes of the web pages are given below.

Fig. I - Registration Screen



The registration screen is a dark-themed modal window titled "New Registration" with a close button in the top right corner. It contains five input fields: "Email ID" with the value "yeshuasandra@gmail.com", "Password" and "Confirm Password" both masked with dots, "Mobile" with the value "9008008001", and "Qualification" with the value "PhD". A teal "Register" button is positioned at the bottom.

Fig. II - Login Screen




The login screen features a background image of stacked stones by a river. The word "LOGIN" is centered at the top in white. Below it are two input fields: the first contains "yeshuasandra@gmail.com" and the second is masked with dots. A teal "LOGIN" button is centered below the fields. At the bottom, the text "Not a Member" is followed by a teal "Register Here !" button.

Fig. III - Search Page with Keyword Search Method

Travancoriana schirnerae

(or)

Country <input type="text" value="India"/>	Habitat <input type="text" value="Fresh Water"/>	Category <input type="text" value="All"/>
Phylum <input type="text" value="Arthropoda Latreille, 1829"/>	Taxonomic Categorization <input type="button" value="↻"/> <input type="text" value="Please Select"/>	Super Family / Family / Sub Family <input type="text" value="Please Select"/>
Genus <input type="button" value="↻"/> <input type="text" value="please select"/>	Species <input type="button" value="↻"/> <input type="text" value="please select"/>	<input type="button" value="GO"/>



***Travancoriana schirnerae* Bott, 1969**


Carapace broader than long, dorsal surface slightly convex in frontal view, flat posteriorly, smooth except postorbital ...

Fig. IV - Search Page with Filter Search Method

Search

(or)

Country <input type="text" value="India"/>	Habitat <input type="text" value="Fresh Water"/>	Category <input type="text" value="All"/>
Phylum <input type="text" value="Arthropoda Latreille, 1829"/>	Taxonomic Categorization <input type="button" value="↻"/> <input type="text" value="Gecarcinucidae Rathbun, 1904 - Family"/>	Super Family / Family / Sub Family <input type="text" value="Gecarcinucidae Rathbun, 1904 - Family"/>
Genus <input type="button" value="↻"/> <input type="text" value="Travancoriana Bott, 1969"/>	Species <input type="button" value="↻"/> <input type="text" value="Travancoriana schirnerae Bott, 1969"/>	<input type="button" value="GO"/>




***Travancoriana schirnerae* Bott, 1969**

Carapace broader than long, dorsal surface slightly convex in frontal view, flat posteriorly, smooth except postorbital ...

In “Species Detailed page”, Diagnosis of the species information is recorded in the “Diagnostic Characters” section. The most important diagnostic characters with which the species could be identified are included in this section.

Fig. V - Species Detailed Page with Diagnostic Characteristics

***Travancoriana schirnerae* Bott, 1969**



Diagnostic Characteristics

Carapace broader than long, dorsal surface slightly convex in frontal view, flat posteriorly, smooth except postorbital cristae, epigastric cristae and lateral margins; postorbital and epigastric cristae distinct, confluent; external orbital angle broadly triangular, with long outer margin, ca.4 times length of inner margin; epibranchial tooth small, blunt, cleft clearly visible . Suture between thoracic sternites 2–3 visible as broad groove not reaching lateral margins; suture between sternites 3–4 visible as broad groove and reaching lateral margins. Male abdomen T-shaped in large males; sixth segment distinctly longer than broad, longer than telson . G1 straight, with long, cone-shaped terminal segment, ca. 0.3–0.4 times length of subterminal segment . G2 with long distal segment, ca. 0.5–0.6 times length of basal segment (Mohomed Bahir and Darren Yeo, 2007).

Taxonomy

Resources

Publications

Leave a comment

Diagnostic Characteristics


“Carapace of *Travancoriana schirnerae* Bott, 1969 is broader than long, dorsal part is little convex at frontal view and is found to be flat posteriorly. It is smooth except the postorbital cristae, the epigastric cristae and at the lateral margins; The postorbital and the epigastric cristae are distinct and confluent; the external orbital angle seems to be broadly triangular, with a long outer margin, ca.4 times length when compared to the inner margin; the epibranchial tooth is small, blunt and the cleft clearly visible . Suture between thoracic sternites 2–3 visible as broad groove but not reaching the

lateral margins; suture between sternites are 3–4 visible as broad groove and reaching the lateral margins. Abdomen of male species is T-shaped in larger males; sixth segment is distinctly longer than broad, longer than telson. G1 is straight, with a long, cone-shaped terminal segment, ca. 0.3–0.4 times length of subterminal segment. G2 with long distal segment, ca. 0.5–0.6 times length of basal segment (Bahir and Yeo, 2007)”.

In “Species Detailed page”, Taxonomy of the species is recorded in the “Taxonomy” section.

Fig. VI - Species Detailed Page with Taxonomy Section

***Travancoriana schirnerae* Bott, 1969**



Travancoriana schirnerae Bott, 1969
(Courtesy : Rajesh, L, Smrithy Raj, Patil, S.K. and Biju Kumar, A., 2017)

Diagnostic Characteristics

Carapace broader than long, dorsal surface slightly convex in frontal view, flat posteriorly, smooth except postorbital cristae, epigastric cristae and lateral margins; postorbital and epigastric cristae distinct, confluent; external orbital angle broadly triangular, with long outer margin, ca.4 times length of inner margin; epibranchial tooth small, blunt, cleft clearly visible . Suture between thoracic sternites 2–3 visible as broad groove not reaching lateral margins; suture between sternites 3–4 visible as broad groove and reaching lateral margins. Male abdomen T-shaped in large males; sixth segment distinctly longer than broad, longer than telson . G1 straight, with long, cone-shaped terminal segment, ca. 0.3–0.4 times length of subterminal segment . G2 with long distal segment, ca. 0.5–0.6 times length of basal segment (Mohomed Bahir and Darren Yeo, 2007).

Taxonomy

Superkingdom:	Eukarya Carl Woese et.al, 1990	Section:	Eubrachyura de Saint Laurent, 1980
Kingdom:	Animalia	Subsection:	Heterotremata Guinot, 1977
Phylum:	Arthropoda Latreille, 1829	Superfamily:	Gecarcinucoidea Rathbun, 1904
Subphylum:	Crustacea Brunnich, 1772	Family:	Gecarcinucidae Rathbun, 1904
Class:	Malacostraca Latreille, 1802	Subfamily:	-
Order:	Decapoda Latreille, 1802	Genus:	<i>Travancoriana</i> Bott, 1969
Infraorder:	Brachyura Latreille, 1802	Species:	<i>Travancoriana schirnerae</i> Bott, 1969

Resources


Publications

Leave a comment

In “Species Detailed page”, 15 resources are listed in the “Resources” section. Clicking on each resource will navigate to the corresponding “Resource detailed page”.

Fig. VII - Species Detailed Page with Resources Section

***Travancoriana schirnerae* Bott, 1969**



Travancoriana schirnerae Bott, 1969
(Courtesy : Rajesh, L, Smrithy Raj, Patil, S.K. and Biju Kumar, A., 2017)

Diagnostic Characteristics

Carapace broader than long, dorsal surface slightly convex in frontal view, flat posteriorly, smooth except postorbital cristae, epigastric cristae and lateral margins; postorbital and epigastric cristae distinct, confluent; external orbital angle broadly triangular, with long outer margin, ca.4 times length of inner margin; epibranchial tooth small, blunt, cleft clearly visible . Suture between thoracic sternites 2–3 visible as broad groove not reaching lateral margins; suture between sternites 3–4 visible as broad groove and reaching lateral margins. Male abdomen T-shaped in large males; sixth segment distinctly longer than broad, longer than telson . G1 straight, with long, cone-shaped terminal segment, ca. 0.3–0.4 times length of subterminal segment . G2 with long distal segment, ca. 0.5–0.6 times length of basal segment (Mohomed Bahir and Darren Yeo, 2007).

Taxonomy

Resources

Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect

Publications

Leave a comment

In “Species Detailed page”, publications done on the species are recorded under the “Publications” section.

Fig. VIII - Species Detailed Page with Publications

Travancoriana schirnerae Bott, 1969



Diagnostic Characteristics

Carapace broader than long, dorsal surface slightly convex in frontal view, flat posteriorly, smooth except postorbital cristae, epigastric cristae and lateral margins; postorbital and epigastric cristae distinct, confluent; external orbital angle broadly triangular, with long outer margin, ca. 4 times length of inner margin; epibranchial tooth small, blunt, cleft clearly visible. Suture between thoracic sternites 2–3 visible as broad groove not reaching lateral margins; suture between sternites 3–4 visible as broad groove and reaching lateral margins. Male abdomen T-shaped in large males; sixth segment distinctly longer than broad, longer than telson. G1 straight, with long, cone-shaped terminal segment, ca. 0.3–0.4 times length of subterminal segment. G2 with long distal segment, ca. 0.5–0.6 times length of basal segment (Mohomed Bahir and Darren Yeo, 2007).

Taxonomy

Resources

Publications

Arath Raghavan Sudha Devi, Moorkoth Kunnath Smija and Bhadravathi Kenchappa Chandrasekhar Sagar., 2015. [Light and electron microscopic studies on the Y organ of the freshwater crab *Travancoriana schirnerae*](#). *Journal of Microscopy and Ultrastructure*.

Arath Raghavan Sudha Devi, Moorkoth Kunnath Smija, Navya Gopal and Sneha Dineshan., 2018. [Effect of eyestalk ablation on mandibular organ activity in the freshwater crab *Travancoriana schirnerae*](#). *International Journal of Fisheries and Aquatic Studies*, 6(2): 184-189.

Aswani Ayanath and Sudha Devi Arath Raghavan., 2020. [Profiling of methyl farnesoate in relation to female reproductive cycle in the freshwater crab, *Travancoriana schirnerae* Bott, 1969 \(Crustacea: Gecarcinucidae\)](#). *Invertebrate Reproduction & Development*.

Latha Nadkandi Padmanabhan, Sudha Devi Arath Raghavan and Chandrashekar Sagar Bhadravathi Kenchappa., 2017. [Ultrastructure of haemocytes of the freshwater crab *Travancoriana schirnerae*](#). *Turkish Journal of Fisheries and Aquatic Sciences*, 17(2):231-243.

Latha Nadkandi Padmanabhan and Sudha Devi Arath Raghavan., 2016. [Impact of eyestalk ablation on androgenic gland activity in the freshwater crab *Travancoriana schirnerae* Bott, 1969 \(Decapoda: Gecarcinucidae\)](#). *Brazilian Journal of Biological Sciences*, v. 3, no. 5, p. 121-134.

Latha Nadkandi Padmanabhan and Sudha Devi Arath Raghavan., 2016. [Impact of unilateral eyestalk ablation on major biochemical parameters of muscle of the freshwater crab *Travancoriana schirnerae* Bott, 1969 \(Decapoda: Gecarcinucidae\)](#). *Brazilian Journal of Biological Sciences*, v. 3, no. 6, p. 341-350.

Latha Nadkandi Padmanabhan, Sudha Devi Arath Raghavan and Aswani Ayanath., 2017. [Impact of methoprene on oogenesis of the freshwater crab *Travancoriana schirnerae* Bott, 1969 \(Decapoda: Gecarcinucidae\)](#). *Brazilian Journal of Biological Sciences*. Vol. 4, No. 7, p. 165-179.

Leave a comment

All the publications are included in the References below.

3.2. Data Collection for the 15 Resources

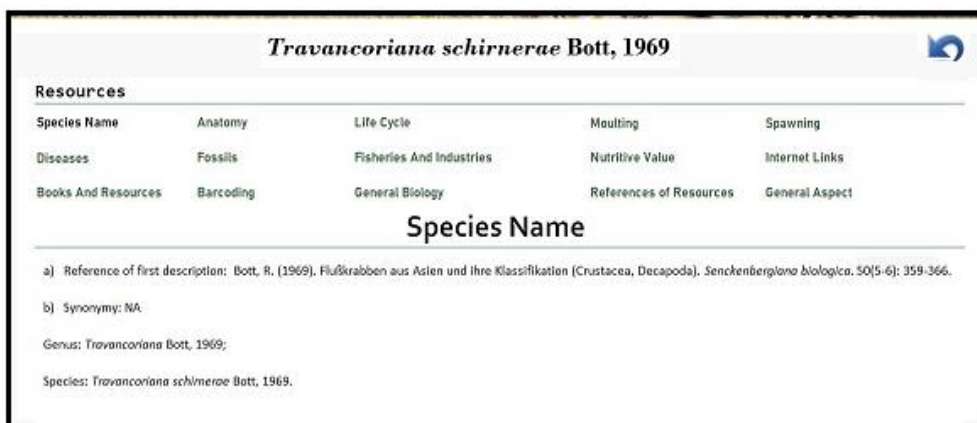
All the collected data are represented as screenshots to explain how the digitization displays the information on “Resource detailed” screen followed by the content of the page.

1. Species Names

In this section original description and Synonym is given.

- a. Original description- The species first reported reference details will be provided here.
- b. Synonym- Includes the various names under which the species was known/ used by various scientists.

Fig. IX - Resource Detailed Page with Species Name



a) Original Description

Bott, R. (1969). Flußkrabben aus Asien und ihre Klassifikation (Crustacea, Decapoda). *Senckenbergiana biologica*. 50(5-6): 359-366.

b) Synonym: Nil

Genus: *Travancoriana* Bott, 1969; Species: *Travancoriana schirnerae* Bott, 1969.

2. Anatomy

All information on Anatomy and related aspects will be discussed here.

Fig. X - Resource Detailed Page with Anatomy

***Travancoriana schirnerae* Bott, 1969**

Resources

Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect

Anatomy

Male reproductive system had paired testes with vasa deferentia divided into anterior, middle and posterior regions. The testes were creamy white, elongated and lobulated structures positioned in the cephalothoracic region. The size (length and width 23.0 and 2.3 mm respectively) of the gonad of normal adult males (length 20-26 mm and width 2.0-2.5 mm). The paired vasa deferentia, creamy white in colour, arose from the posterior ends of the testes and extended posteriorly in the form of thick coiled tubules. The posterior vas deferens narrowed to form a thin ejaculatory duct which pierced the muscles of the 5th pereopod to open at the base of the coxa through external penis. The wet weight of testis for adult males (80-160 mg and 220-400 mg respectively). The values of GSI is 0.155-0.316 and VD factor is 101-254 (Sudha Devi and Smija, 2014).

The female reproductive system consists of paired ovaries, oviducts, gonopores and spermathecae. The ovary is H-shaped with anterior and posterior lobes, connected by a transverse bridge of ovarian tissue, located mid-dorsally in the cephalothorax. An oviduct which arises laterally from the posterior part of each ovary extends ventrally and opens out through the coxa of the third walking leg. A pear shaped spermatheca which stores spermatozoa received during copulation was found proximally attached to each oviduct (Navya Gopal and Arath Raghavan Sudha Devi, 2019).

The Male Reproductive System

The male reproductive system of *Travancoriana schirnerae* Bott, 1969 consists of paired testes with vasa deferentia which is divided into the anterior, the middle and the posterior regions. The testes were in creamy white in colour, elongated and lobulated structures which are positioned in cephalothoracic region. The paired vasa deferentia, were creamy white in colour, which arose from posterior ends of testes and they are extended posteriorly in the form of a thick coiled tubules. The posterior vas deferens found to be narrowed which form a thin ejaculatory duct that pierced the 5th pereopod muscles to open at the base of coxa through the external penis. The wet weight of testis in the adult males were (80-160 mg and 220-400 mg respectively). The GSI value is 0.155-0.316 and the VD factor was to be 101-254 (Raghavan and Moorkoth, 2014a).

The Female Reproductive System

The female reproductive system of *Travancoriana schirnerae* Bott, 1969 consists of paired ovaries, oviducts, gonopores and spermathecae. The ovary seems to be H-shaped with an anterior and posterior lobes and are connected by a transverse bridge comprises of ovarian tissue, it is located in the cephalothorax (mid-dorsally). An oviduct arises laterally from the posterior part of each ovary which extends ventrally and it opens out through coxa of the third walking leg. A pear shaped spermatheca which is capable of storing spermatozoa received during the process of copulation was found to be proximally attached to each oviduct (Gopal and Raghavan, 2019).

3. Life Cycle

Life Cycle related information of the species are recorded in this section.

Fig. XI - Resource Detailed Page with Life Cycle

<i>Travancoriana schirnerae</i> Bott, 1969				
Resources				
Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect
Life Cycle				
Mating :				
Usually males will be larger than females. The possible reason for this may be that large males with bigger major chelipeds are more successful at acquiring mates (Wilber, 1987) and in handling females during copulation (Hartnoll, 1982). <i>T. schirnerae</i> , males copulate with the females they guard and do not guard the females they do not mate with, as documented by Wilber (1987) in stone crabs. In <i>T. schirnerae</i> , females usually remain seized in male burrows before mating as evidenced by the presence of mating pairs in burrows. Such burrow-mating systems are more advantageous to monogamy (Sudha Devi and Smija, 2013).				
Breeding :				
<i>T. schirnerae</i> is an annual breeder with a short breeding season which extended from February end to May (summer) with peak in March. Breeding in summer months is thought to be advantageous to ensure embryonic development before rainy season (colder months) (Sudha Devi and Smija, 2013).				
Growth Pattern:				
Males were found larger and heavier than females (CW 4.6±0.49 and 4.5±0.39 cm and weight 36.56±12.16 and 32.09±7.50 g respectively for males and females) (t=2.00 and 3.88 respectively, p <0.05). Males grew more rapidly than females as evidenced from the markedly larger moult increments in CW and weight (Sudha Devi and Smija, 2015).				

The Mating

Usually the males are reported to be larger than females. The length and width of the species were 23.0 and 2.3 mm respectively and of the gonad of any normal adult males were 20-26 mm in length and 2.0-2.5 mm in width. The possible reason for this may be that large males with bigger major chelipeds are more successful at acquiring mates (Wilber, 1987) and in handling females during copulation (Hartnoll, 1982). *T. schirnerae*, males copulate with those females which they guard. And those do not guard the females, do not mate with, by Wilber (1987) in the stone crabs. In *Travancoriana schirnerae* Bott, 1969, the females generally remain seized in the male burrows before the mating process as evidenced by the presence of mating pairs in the burrows. Such burrow-mating systems seem to be more advantageous to monogamy (Raghavan and Moorkoth, 2013b).

The Breeding

Travancoriana schirnerae Bott, 1969 is found to be seasonal breeder with a short breeding season which extended from the month of February end to May (summer season) with a peak in the month of March. Breeding of the species is during the summer months is a thought to be

advantageous to ensure the embryonic development before the rainy season (colder) (Raghavan and Moorkoth, 2013b).

The Growth Pattern

Males were found to be larger and heavier when compared with the females (CW 4.6 ± 0.49 and 4.5 ± 0.39 cm and weight 36.56 ± 12.16 and 32.09 ± 7.50 g respectively for males and females) ($t=2.00$ and 3.88 respectively, $p < 0.05$). Males tend to grow more rapidly when compared with the females as evidenced from markedly larger moult increments in the CW and in the weight (Raghavan and Moorkoth, 2015a).

4. Moulting

Moulting process of the species is recorded in this section.

Fig. XII - Resource Detailed Page with Moulting

***Travancoriana schirnerae* Bott, 1969**

Resources				
Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect

Moulting

Males and females have similar moult cycles. The intermoult intervals differed between the sexes; tend to be longer for females, related to their higher energetic outlay for reproduction (Sudha Devi and Smija, 2015).

The male and the female species seem to have similar moult cycles. The intermoult intervals are found to be different between the male and the female; intermoult intervals tend to be longer for the females, which are related to their higher energetic outlay for the reproduction process (Raghavan and Moorkoth, 2015a).

5. Spawning

Spawning information of the species is recorded in this section.

Fig. XIII - Resource Detailed Page with Spawning

***Travancoriana schirnerae* Bott, 1969**

Resources

Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect

Spawning

Travancoriana schirnerae spawns once in a year (Sudha Devi and Smija, 2013).

Travancoriana schirnerae spawns once in a year (Raghavan and Moorkoth, 2013b).

6. Diseases

Diseases information of the species is recorded in this section.

In this case, Data not found.

Fig. XIV - Resource Detailed Page with Diseases

***Travancoriana schirnerae* Bott, 1969**

Resources

Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect

Diseases

Data not found, Still working on that.

7. Fossils

Fossils related information of the species are recorded in this section

In this case, Data not found.

Fig XV: Resource detailed Page with Fossils

<i>Travancoriana schirnerae</i> Bott, 1969				
Resources				
Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect
Fossils				
Data not found, Still working on that.				

8. Fisheries and Industries

Fisheries and Industries of the species information are recorded in this section.

In our case, Data not found.

Fig. XVI - Resource Detailed Page with Fisheries and Industries

<i>Travancoriana schirnerae</i> Bott, 1969				
Resources				
Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect
Fisheries And Industries				
Data not found, Still working on that.				

9. Nutritive Value

Food/Meat/ Dietary value of the species are recorded in this section.

Fig. XVII - Resource Detailed Page with Nutritive Value

<i>Travancoriana schirnerae</i> Bott, 1969				
Resources				
Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect
Nutritive Value				
<p><i>Travancoriana schirnerae</i> Bott, 1969 is edible and forms a cheap source of animal protein to the poor malnourished local tribes. The natives consume the ovary alone during the breeding season. The meat is low in fat, high in protein and is a moderate source of free amino acids. The values of protein, free amino acid and moisture contents are on par with or greater than those of other freshwater, marine and brackish water crabs. The proportion of total protein, free amino acids, carbohydrate was found to be higher in females than males which suggest their nutritional value over males (Sudha Devi and Smija, 2013).</p> <p><i>T. schirnerae</i> meat might be considered as an innovative source of essential fatty acids and therefore can be used as a source of meat for human as well as an ingredient of animal feed for aquaculture industry (Sudha Devi <i>et al.</i>,2015).</p>				

Travancoriana schirnerae Bott, 1969 is reported to be edible and serve as a cheap source of animal protein to the local people with poor malnourishment. The maturing ovary alone is being consumed by the natives. The meat is found to be low in fat, with rich protein and moderate source with free amino acids. The proportion of total protein, free amino acids, carbohydrate was higher in females when compared with the males (Raghavan and Moorkoth, 2013a).

Travancoriana schirnerae Bott, 1969 meat could be taken into account as an innovative source of essential fatty acids, which could be considered as a source of meat for the humans and as well as it could be used along with the animal feed for aquaculture industry (Raghavan et al., 2015).

The mean protein, oligo and polysaccharides, moisture, lipid, FAA and cholesterol contents of crab meat were found to be 19.39%, 0.38%, 0.51%, 83.02%, 369.5 mg, 1469 mg and 21.3 mg/100 g respectively (Raghavan and Moorkoth, 2013a).

10. Internet Links

Available Internet links of the species are listed in this section.

Fig. XVIII - Resource Detailed Page with Internet Links

***Travancoriana schirnerae* Bott, 1969**

Resources

Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect

Internet Links

1. <http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T134598A3984116.en>
2. <http://www.marinespecies.org/aphia.php?p=taxdetails&id=440578>
3. <https://www.crabdatabase.info/en/crabs/brachyura/eubrachyura/heterotremata/gecarcinucoidea/gecarcinucidae/travancoriana-10048>
4. <https://indiabiodiversity.org/species/show/224501>
5. <https://eol.org/pages/7260314>
6. <https://nl.wikipedia.org/wiki/Travancoriana>
7. <https://www.biolib.cz/en/taxon/id1061118/>
8. https://wiki2.org/en/List_of_least_concern_arthropods
9. <https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?mode=info&id=303056&lvl=3&lin=f&keep=1&srchmode=1&unlock>

1. <http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T134598A3984116.en>
2. <http://www.marinespecies.org/aphia.php?p=taxdetails&id=440578>

3. <https://www.crabdatabase.info/en/crabs/brachyura/eubrachyura/heterotremata/gecarcinuocidea/gecarcinucidae/travancoriana-10048>
4. <https://indiabiodiversity.org/species/show/224501>
5. <https://eol.org/pages/7260314>
6. <https://nl.wikipedia.org/wiki/Travancoriana>
7. <https://www.biolib.cz/en/taxon/id1061118/>
8. https://wiki2.org/en/List_of_least_concern_arthropods
9. <https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?mode=Info&id=303056&vl=3&lin=f&keep=1&srchmode=1&unlock>

11. Books/ Resources

Books and resources related to the species are listed in this section.

Fig. XIX - Resource Detailed Page with Books and Resources

***Travancoriana schirnerae* Bott, 1969**

Resources

Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect

Books And Resources

Book: Sudha Devi Arath Raghavan, 2017. [Aspects of Biology of the Freshwater Crab: *Travancoriana schirnerae*](#). LAP LAMBERT Academic Publishing.

Thesis: Smija.N.K., 2014. Growth and reproduction in the freshwater crab *Travancoriana schirnerae*. Mary Matha Arts & Science College- Kannur University Created and maintained by INFLIBNET Centre.

Project: [Role of methyl fanoate on growth and reproduction in the freshwater crab *Travancoriana schirnerae*](#) Sudha Devi. [Spider fauna of Wyanad. Dietary value of crab meat, role of eyestalk hormones on growth and reproduction in the freshwater crab *Travancoriana schirnerae*](#) Sudha Devi.

Book: S.D. A.Raghavan. Aspects of Biology of the Freshwater Crab: *Travancoriana schirnerae*, LAP LAMBERT Academic Publishing, 2017.

Thesis: N. K.Smija. Growth and reproduction in the freshwater crab *Travancoriana schirnerae*, Mary Matha Arts & Science College- Kannur University Created and maintained by INFLIBNET Centre, 2014.

12. Barcoding

NCBI URL of the barcoding information of species is recorded in this section.

Fig. XX - Resource Detailed Page with Barcoding

The screenshot shows the NCBI Taxonomy page for *Travancoriana schirnerae* Bott, 1969. At the top, the species name is displayed in a grey box. Below it is a 'Resources' table with five columns: Species Name, Anatomy, Life Cycle, Moulting, and Spawning. The second row contains Diseases, Fossils, Fisheries And Industries, Nutritive Value, and Internet Links. The third row contains Books And Resources, Barcoding, General Biology, References of Resources, and General Aspect. The 'Barcoding' link is highlighted. Below the table, the heading 'Barcoding' is centered, followed by a URL: <https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?mode=Info&id=303056&lvl=3&lin=f&keep=1&srchmode=1&unlock>

<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?mode=Info&id=303056&lvl=3&lin=f&keep=1&srchmode=1&unlock>

13. General Biology

General Biology information for example the Color of the species information is recorded in this section.

Fig. XXI - Resource detailed Page with General Biology

The screenshot shows the NCBI Taxonomy page for *Travancoriana schirnerae* Bott, 1969. It features the same 'Resources' table as Figure XX, with 'General Biology' highlighted. Below the table, the heading 'General Biology' is centered. Underneath, the text reads: 'Colour Pattern : In *T. schirnerae*, adult male and female crabs exhibited identical colour patterns and three morphotypes were recognized which were yellow, intermediate and purple (Sudha Devi and Smija, 2015).

The Colour Pattern

Adult male and female species has identical colour patterns. Three morphotypes have been recognized and found to be in yellow, intermediate and in purple (Raghavan and Moorkoth, 2015b).


15. Source of References of Resources

All the content references of the species are listed in this section.

All information's are included in the below References.

Fig. XXII - Resource detailed Page with Reference of the Resources

Travancoriana schirnerae Bott, 1969



Resources

Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect

References of Resources

- 1) Pati, S. K. and Thackeray, T., 2018. The Freshwater Crab Genera Ghatiana Pati and Sharma, Gubernatoriana Bott, and Inglethelphusa Bott (Crustacea: Decapoda: Brachyura: Gecarcinucidae) Revisited, With Descriptions Of A New Genus and Eleven New Species. *Zootaxa*, 4440 (1): 001–073.
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- 5) Sudha Devi, A. R. and Smija, M. K., 2014. Histologically Confirmed Intersex (Ovo-testis) In The Freshwater Crab *Travancoriana Schirnerae* (Bott, 1969). *International Journal Of Fisheries and Aquatic Studies, Kerala.*, 1(3): 99-104.
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- 9) Sudha Devi, A. R. and Smija, M. K., 2015. Size Distribution and Colour Pattern In The Freshwater Crab *Travancoriana Schirnerae*. *International Journal Of Fisheries and Aquatic Studies, Kerala.*, 2(4): 264-268.
- 10) Sudha Devi, A. R. and Smija, M. K., 2015. Growth and Moulting Pattern In The Freshwater Crab *Travancoriana Schirnerae* . *International Journal Of Fisheries and Aquatic Studies, Kerala.*, 3(2): 391-396.
- 11) Arath Devi, R.s. and Moorkoth Smija, K., 2013. Seasonal Changes In The Structure and Secretory Activity Of The Androgenic Gland Of *Travancoriana Schirnerae*. *Cent. Eur. J. Biol, Kerala.*, 9(1): 70-79.

16. General Aspect

In this section the distribution of the species across India are given.

Fig. XXIII: Resource detailed Page with General Aspect

***Travancoriana schirnerae* Bott, 1969**

Resources

Species Name	Anatomy	Life Cycle	Moulting	Spawning
Diseases	Fossils	Fisheries And Industries	Nutritive Value	Internet Links
Books And Resources	Barcoding	General Biology	References of Resources	General Aspect

General Aspect

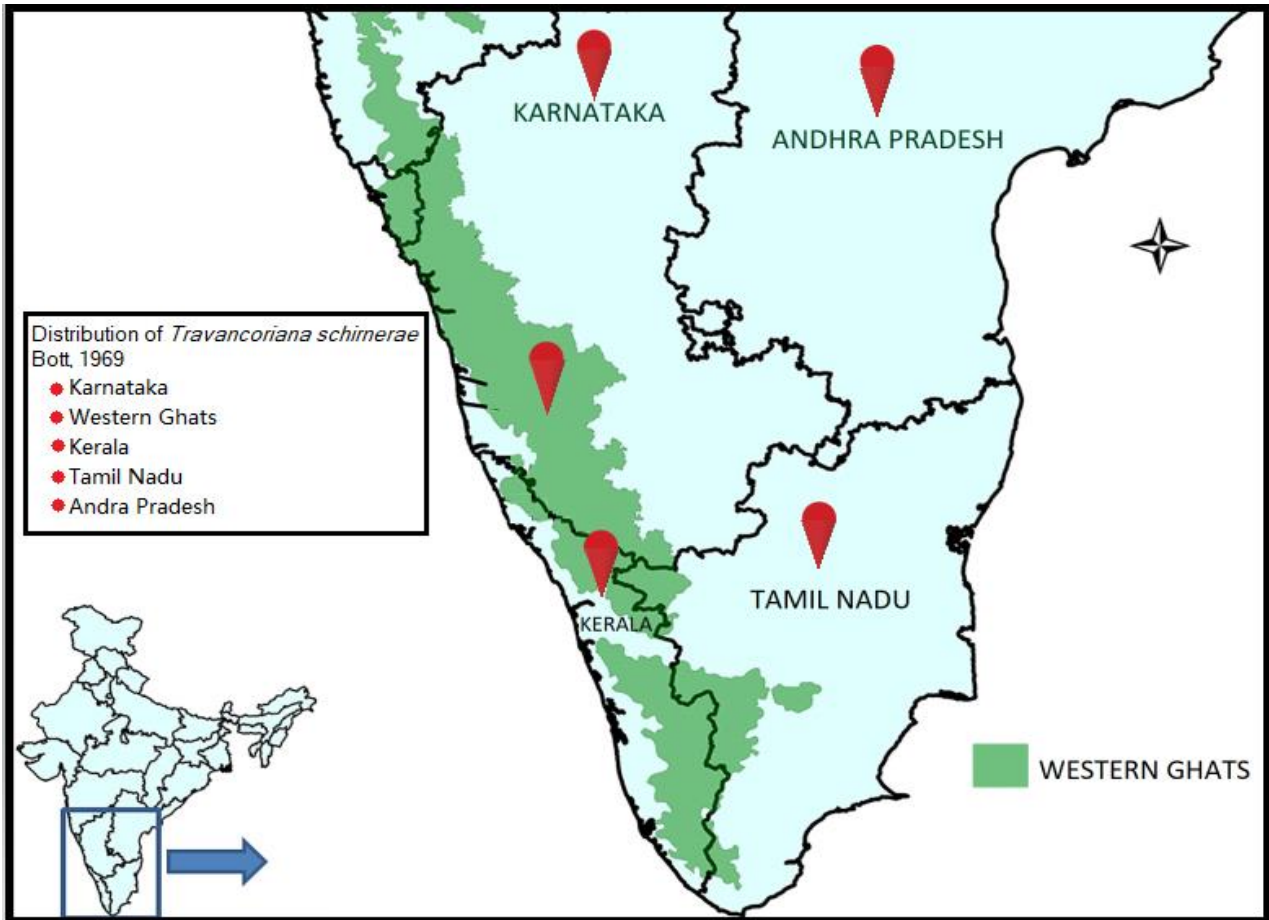
Distribution of the species *Travancoriana schirnerae* Bott, 1969 in India

- Karnataka
- Western Ghats
- Kerala
- Tamil Nadu
- Andra Pradesh

(Pati, S. K. and Thackeray, T., 2018)

Distribution of the species *Travancoriana schirnerae* Bott, 1969 in India (Karnataka, Western Ghats, Kerala, Tamil Nadu, Andra Pradesh (Pati and Thackeray, 2018))

Fig. XXIV - Distribution of the Species *Travancoriana schirnerae* Bott, 1969 in India



4. Conclusion

The paper provides a web portal that covers all the valuable information collected from various sources about the Indian Freshwater crab, *Travancoriana schirnerae* Bott, 1969. The data collected has been conveniently classified or categorized into 15 areas mentioned already. It presents a background information to all those interested to continue further in research in this area. Future work to create such database continues for other species

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