A MINI REVIEW ON BIOPROSPECTING OF FISH VENOM

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Abstract: Fish venoms can be lethal for Vertebrates. The venomous fishes have been recognized for many years; however scientific investigators have finding the pharmacological importance of fish toxin. Nearly 1200 species of marine fish are venomous and they account for two third of the population of venomous vertebrates. Fish venoms are focused as a potential source of pharmacological agents and physiological tools that have evolved to target vital processes in the human body that appear to have more electivity than many drugs. In the present review focused the exploration and importance of venomous from certain fishes.

Index Terms - Fish Toxin, Exploration, Pharmacological Importance, Toxicology.

I. INTRODUCTION

Poisonous organisms are represented in many taxa, including kingdom Animalia. During evolution, animals have developed special organs for production and injection of venoms. Animal venoms are complex mixtures, compositions of which depend on species producing venom. The most known and studied poisonous terrestrial animals are snakes, scorpions and spiders. Among marine animals, these are jellyfishes, sea anemones and cone snails. The toxic substances in the venom of these animals are mainly of protein and peptide origin. Recent studies have indicated that the single venom may contain up to several hundred different components producing diverse physiological effects. Bites or stings by certain poisonous species result in severe envenomations leading in some cases to death. This raises the problem of bite treatment. The most effective treatment so far is the application of antivenoms. To enhance the effectiveness of such treatments, the knowledge of venom composition is needed. On the other hand, venoms contain substances with unique biological properties, which can be used both in basic science and in clinical applications.

Animal venoms and toxins are now recognized as major sources of bioactive molecules that may be used as a drug. There are more than 250 species of marine fish including Stingrays, Scorpionfish, Zebrafish, Stonefish, Weeverfish, Toadfish, Stargazers and some species of Shark, Ratfish, Catfish, Surgeonfish and Blenny are known or suspected to be venomous. Venom is a secretion produced in a specialized gland in one animal and delivered to the predator. This secretion contains molecule that disrupt normal physiological processes. Venoms may be used to kill prey and/or to defend the delivering organism against attack by predators. Venoms are complex mixtures of pharmacologically highly active substances and can cause a wide range of symptoms (http:// itsnature.org/sea/scorpionfish/ downloaded). While venoms featured in several systems of traditional healing, the modern translation of toxins into medicines began in the 1940's. The toxins found in venomous and poisonous animals have evolved over time to play a critical role in prey capture, immobilization and defense for these organisms. For millennia humans have held both a fascination and fear of the actions of venomous and poisonous animals and as such this has been an active area of research, scientific and otherwise since the time when humans made the correlation of illness or death associated with their interactions with venomous and poisonous animals.. As a point of reference one should understand that when the term "venomous" animal is used we are referring to animals which generate venom via a tissue or organ such as a venom gland. The venom is typically introduced into prey organisms via parenteral application with a specialized apparatus such as a nematocytes or spines. On the other hand, poisonous animals produce toxins in a similar manner via specialized cells or tissues or they may acquire toxins from the environment typically via their diets. The toxins from poisonous animals must generally be ingested by predator organism for their toxic actions to occur. An exception being certain poisonous animals such as frogs which secrete their poisons from their skin which then cause irritation to the predator via contact or ingestion with the poisonous animal (Halstead, 1956). There are both venomous and poisonous marine animals and land animals. Toxins and poisons from animals have been utilized as drugs and drug leads for treatment of human diseases and several of these will be discussed. Detailing the structures and functions of the various animal toxins provides several interesting research avenues in terms of protein engineering and

therapeutic potential, while the peptide and protein therapeutic market has developed significantly in the past decades (Church, 2002). In the present review discussed about the toxin from fish and their Importance.

II. EXPLORATION OF FISH TOXIN

The production of toxins by aquatic animals is an important strategy that guarantees its survival in a highly competitive ecosystem. In this way, these animals defend themselves or their territories and produce a significant number of metabolites, which in combination results in a great variety of chemical structures and complex molecules, such as alkaloids, steroids, peptides and proteins with chemical and pharmacological properties, different from those venoms of terrestrial animals (Russell, 1971).

Discoveries of toxins from venoms, for the most part from marine resources that are racing ahead because of their extremely complex and notable action on various mammalian physiological systems (Sivan *et al.,* 2007). Toxic proteins serve in a number of adaptive roles such as immobilizing paralyzing, killing, liquefying competitions. Other venom proteins may act synergistically by enhancing the activity or spreading of toxins (Garnier *et al.,* 1965).

Many cases of scorpaenidae envenomation have been reported in different parts of the world. Fishes of the family scorpaenidae are responsible for severe injuries but their venom contains active components which are of pharmacological importance. Scorpaenidae venoms have been recognized as potential source of pharmacological agents and physiological tools. Their venom interacts with physiologically important molecular targets and affects the vital function of organisms. In most cases, toxin present in venom is responsible for physiological effects. Scorpaenidae venom produces distinct cardiovascular changes. Stonustoxin is responsible for causing endothelium dependent relaxation at low concentration and shows endothelium independent contraction at high concentration. P. volitans venom produces hypotensive response whereas S. trachynis venom produces hypertensive response. The lethal toxin of S. trachynis venom (TLY) is responsible for the release of acetylcholine from the neuromuscular junction. Some of the toxins have neurotoxic effects which includes paralysis of hind limbs, muscular weakness and at higher doses causes coma and respiratory failure. Many of the fish venoms contain toxin responsible for erythrocyte lysis. The mechanism behind erythrocyte lysis by SNTX is through the formation of hydrophilic pores in the cell membrane. P. volitans hemolytic activity is found to be selective to rabbit erythrocytes. SNTX activity gets altered as the numbers of tryptophan residues get decreased. Scorpaenidae fish venom possess different properties which can be utilized for research tools and potential drug development Kirti *et al.,* (2013).

Carrijo *et al.,* (2005) describe some biological properties and a partial biochemical characterization of the *Scorpanea plumieri* crude venom. In his study the fresh venom induced a decrease in blood pressure, cardiac and respiratory frequency, and exhibited hemorrhagic, hemolytic and proteolytic activities. The LD_{50} (i.v. mouse) was 0.28 mg/kg. The pharmacological activities were found to be very unstable and this fact could be associated with proteolytic activity. Enzymes which hydrolyze casein and gelatin were found in this venom. A gelatinolytic protease (Sp-GP) was purified to homogeneity from *S. plumieri* venom through a combination of three chromatographic steps: gel filtration on Sephacryl S-200; ion exchange on DEAE-cellulose and reverse-phase/HPLC on a Vydac C4 column. The purified protease was approximately 2% of the whole protein in the soluble crude venom. The molecular mass of the Sp-GP scorpionfish gelatinase estimated by SDS-PAGE was around 80,000 Da under reducing conditions and 72,000 Da under non-reducing conditions. Attempts to determine the N-terminal sequence by automatic Edman degradation were unsuccessful, probably due to blockage of the N-terminal group. Gelatinolytic activity was optimal at pH 7–8. This is the first report of the isolation and characterization of a scorpionfish venom protease.

Santos *et al.,* (2007) Carried comparative study of biological and biochemical activities of venoms of Brazilian fishes with medical importance. In Brazilian waters many species of venomous fishes are found, but 5 species are frequently involved with human accidents: *Potamotrygon orbignyi* (Po), *Cathrops spixii* (Cs), *Pseudoplatystoma fasciatum* (Pf), *Scorpaena plumieri* (Sp), and *Thalassophryne nattereri* (Tn). Usually, the clinical features induced by these fish venoms are pain, edema, and necrosis. In this work he compared the biological and biochemical activities induced by these different fish venoms. Toxic activities (nociception-10 µg, edema -10 µg, necrosis -30 µg) and alterations in the microcirculatory net were induced in Swiss mice by application of 10 µg of venoms, which were analysed by 12% SDS-PAGE and chromatography. Gelatinase, phospholipase A2 (PLA2) and proteolytic activity were also determined. Tn induced the highest level of nociception and edema, and the venoms of Sp and Po induced the lowest levels of nociception or edema, respectively. Only Tn venom induced necrosis and hemolitic activity. Alterations in microcirculation were not observed after application of Sp venom. All venoms presented

proteolytic activity, and Tn venom was devoid of PLA2. The SDS-PAGE and zymography showed a high similarity between Pf and Cs venoms. The chromatography shows that Po, Cs, Pf, and Tn presented a similar band around 18 kDa and Sp presented proteins with high molecular weight (> 100 kDa). This is the first study that compares the toxic activities and biochemical characteristics of the venoms from the major Brazilian venomous fishes: the venom of Tn showed the highest toxic activities and Sp venom presented the lowest, but with systemic effects.

Wilcox and Hixon, (2014) studied False positive tests for ciguatera may derail efforts to control invasive lionfish. In his study preliminary results suggest that scorpaenitoxins or other venom components are capable of contaminating ciguatoxin assays, and thus they urge caution regarding interpretation of ciguatoxin assays in invasive lionfishes.

Bernabe and Reeves, (2013) isolated microbial compounds from the invasive Lion Fish (*Pterois volitans*). In this experiment he designed to test the effectiveness of the venom extracted from the lionfish as an alternative medicine to controlling or hindering the growth of the bacterium MRSA when applied to the infected area. The efficiency of the isolated venom was evaluated by looking at the growth rates of the different colonies of MRSA were treated with the venom. The venom proved to not hinder the growth of the MRSA bacteria a significant amount.

Prithiviraj and Annadurai (2012) studied on bioactive properties of the catfish *plotosus canius* (hamilton, 1822*) sting* venom and epidermal mucus. In this experiment he found that spine and mucus extract of catfish having significant antimicrobial activity. In particularly mucus extracts showed much activity than spine extracts. The crude extract was partially purified by using DEAE cellulose. The antioxidant property of the extract was assessed by 2, 2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging method .The toxic activity of crude extracts were determined by illeal loop in chick respectively. The haemolytic activities in chick, goat, and human blood erythrocytes were recorded. The result reported that mucus extracts showed a very strong haemolytic activity than spine extracts. The estimation of protein gist were intervened by SDS –PAGE and the results showed that all the extracts showed significant number of protein bands in range from 7 KDa to 21 KDa respectively. It could be surmised from the contemporary study that *Plotosus canius* venom boasts an assorted mixture of peptides, protein and pharmacologically active components.

III. CONCLUSION

Venomous marine fish account for nearly two thirds of the population of venomous vertebrates, and include stingrays, scorpionfish, zebrafish, stonefish, and some species of shark, catfish, and blenny. Fish venoms are thought to have originated on at least 18 occasions via the process of convergent evolution However, while significant research effort has focused on characterizing the biological activity of venom from terrestrial animals particularly snakes little is known about the composition or biological activity of venom from many species of fish. A main reason that these marine vertebrates remain understudied is the difficulty in obtaining, storing, and extracting venom samples. Nevertheless, marine venoms represent a diverse source of untapped biological compounds which, when considering the utility of toxins isolated from other venomous lineages, may be useful as potential research, pharmaceutical, or diagnostic tools.

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