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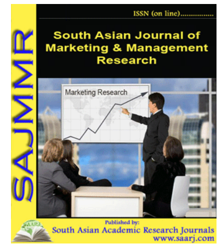

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A STUDY OF VIRAL INFECTIONS IN COMMERCIALLY HARVESTED CRABS

Piyush Mittal*; Neelanchal Trevedi; Rahul Arora***; Shubham Singh Tyagi****; Rishi K Poodar*******

*Department of Pharmacy, Teerthanker Mahaveer University,
Moradabad, Uttar Pradesh, INDIA
Email id: piyush.pharmacy@tmu.ac.in

**Department of Pharmacy, Teerthanker Mahaveer University,
Moradabad, Uttar Pradesh, INDIA

***Department of Pharmacy, Teerthanker Mahaveer University,
Moradabad, Uttar Pradesh, INDIA

****Department of Pharmacy, Teerthanker Mahaveer University,
Moradabad, Uttar Pradesh, INDIA

*****Department of Pharmacy, Teerthanker Mahaveer University,
Moradabad, Uttar Pradesh, INDIA

ABSTRACT

Crab viruses related viral illnesses were discovered and studied long before viruses were discovered in shrimp. Crabs were employed as biological models to study crustacean virology from the start of the shrimp aquaculture industry. More than 30 viruses have been identified in crabs, comprising members of the Reoviridae, Bunyaviridae, Roniviridae, and a group of Bacilliform enveloped nuclear viruses. This study presents information on a number of major viral infections that affect crabs, especially those that are linked to pathology in the organs and tissues of economically and ecologically important host species.

KEYWORDS: *Genome Structure, Nuclear Viruses, Marine Crabs, Reoviridae, Tau Virus, Viral Diseases*

INTRODUCTION

Crab viruses are the earliest crustacean viruses discovered in decapods. Vago discovered the first crustacean virus in the Mediterranean crab Portunus depurator. Since then, many reports of viral infections in various crab species have been published, especially in the first half of the century. Whenever documented biochemical characteristics were sparse, these descriptions were relied mostly on morphological data, whether or whether they were associated with mortalities. Viruses found in crabs are as least as numerous as those found in shrimp and prawns, and they are closely linked to recognized virus families. Of However, since only a few of them were biochemically described, the majority were only linked to virus families based on their morphological characteristics, such as viral particle shape and size, cytoplasmic or nuclear location, and tissue affinity of the virions[1]. Due to the economic pressures of shrimp farming, shrimp viruses were genetically defined, and as a result, detection techniques were successfully developed. Because crabs have a lower economic value than shrimp and are most frequently captured in the wild rather than farmed, scientific efforts have been less significant, as shown by sluggish scientific development in viral pathology. Furthermore, the economic worth varies greatly depending on the country: for example, the Chinese mitten crab Eriocheirsinensis has little commercial value in Western nations, but is farmed and marketed in Asian markets, especially in China. Only significant virus families or groups of viruses of interest in the field, as well as viral illnesses and viruses of crabs having a genuine economic effect, are reported here[2].

1. Viruses in the Reoviridae family

The first virus described in a crustacean, as well as some other uncharacterized viruses that share common morphological and biological features with the family, and some other viruses that have been sufficiently well characterized to be considered members of the family, are all members of the Reoviridae family. By the number of distinct viruses reported, as well as our understanding of their structure, morphogenesis, and genetic data, this family is the most represented among crab viruses. Furthermore, several of these viruses are noteworthy in terms of comparative virology because of their unique and distinctive characteristics. Except for the virus described by Vago, for which only the form and size are known, all other viruses have the capacity to grow in the cytoplasm of infected cells and have an icosahedral shape, a double shelled capsid, and a size that is closely similar. All of them have a multi-segmented dsRNA genome[3].

2. Hosts and geographic distribution

Eight distinct reovirus or reo-like particles have been found in crabs, with varied geographic distributions and hosts. P virus was originally discovered in M. depurator, and W2 was named after W virus, which was discovered in Weymouth but not in Carcinusmaenas in Carcinusmediterraneus. The W virus was discovered in C. maenas collected in front of the Weymouth laboratory in the English Channel, and it was later isolated from the blue crab C. sapidus from Chincoteague Bay, Virginia, USA. In Hubei and Jiansu provinces, respectively, EsRV905 and EsRV806 were isolated from the Chinese mitten crab E. sinensis. MCRV has been linked to mortality in the mud crab Scylla serrata in the southern Chinese provinces of Guandong and Fujian. At the same time, Zhang et al. reported SsRV, a related virus from the same region. Diseases were experimentally recreated in their native hosts, with the exception of RC84, via injection or contamination, including viral development and related.

3. Lesions and tissue tropism

RC84 differs from the other members of this group in terms of tissue tropism. It is only seen at the hepatopancreatic epithelial level, especially in the cytoplasm of B-cells, where it forms huge, electron-dense viral regions with no identifiable particle attachment. However, there are just a few crystalline arrays of virions to be found. All other viruses are systemic, spread via the bloodstream, and develop primarily in the connective tissues of all organs. UV microscopy with acridine orange staining shows that P virus and RLV create enormous crystalline arrays of virions in the cytoplasm. W and W2 create cytoplasmic structures known as "rosettes." In section, 5–7 particles make up the rosettes. They are structured in tiny spheres of ordered virions that delimit a center empty volume in terms of volume[4].

4. Characteristics of biochemistry and genomic structure

The double-layered capsid has been shown for the majority of viruses in this category. TEM in pure W2 virions demonstrates this especially effectively. Capsid protein composition data is limited, and only for P and W2 virions is known. P virus has four polypeptides, whereas W2 has six, ranging in size from 24 to 120 kDa. The structure and biological makeup of the capsid of the other crab reoviruses remain unknown.

5. Genes that are transmitted by viruses

The placement of genes in various RNA components, as well as their structure and function, are all unknown in this viral family. Too far, partial sequences of three distinct segments have been obtained from the P virus in terms of genomic sequences. They were produced by cloning genomic RNA fragments, and the various cDNAs obtained were utilized in in situ hybridization studies after being labeled. The ORF-derived polypeptide has an estimated mass of 139 kDa and is made up of 1217 amino acids. Members of the genus Seadornavirus, especially Kadipiro and Banna virus, shared sequence homologies. According to phylogenetic study based on sequence alignment of RdRp from members of various genera in the Reoviridae family, viruses from the genus seadornavirus and certain rotavirus have close relatives. However, given the variations in hosts (insects and crabs), electrophoretypes, and genome size, EsRV905 is most likely the paradigm for a new genus in the family[5].

6. Prevalence and commercial impact

The frequency and impact of RLV in C. sapidus from its major fishery on the US East coast are unknown. In reality, no percentage loss has been calculated for blue crab illnesses (or viral diseases). Similarly, information on the effect of EsRV905, which infects the Chinese Mitten crab, is limited. EsRV905 was found in the major crab cultivation regions in China between 2000 and 2007, including Jiangsu, Shanghai, Anhui, and Hubei provinces (. The virus may be found in all four seasons, although the incidence of infection is considerably greater in the summer. In wild crabs, EsRV905 is often discovered in combination with other diseases. Infection of E. sinensis with pre-purified EsRV905 resulted in only 30% cumulative death, although the virus was identified in surviving crabs[6].

7. Viruses in the Roniviridae family

A crab illness, dubbed "sigh disease" by farmers due to apparent "respiratory" problems that are plainly audible at night and linked to black gill syndrome (BGS), was recently discovered in the Chinese Mitten Crab E. sinensis on a farm in Hubei Province, PR China. Non-specific related symptoms included anorexia and sluggishness. Inoculation of infected hemolymph into healthy crabs was used to replicate the illness in the lab. EsRNV, a virus with morphological similarities to members of the Roniviridae family, was discovered in experimentally infected animals. The lymphoid organ, connective tissue of the gills, hepatopancreas, heart, and gut all showed signs of EsRNV infection. Several debris deposits were discovered between the various gill lamellae in gills. The infection caused a multifocal to widespread necrosis, with pyknosis and karyorrhexis in connective cell nuclei producing inclusion-like formations. After acridine orange staining, large masses with a bright yellow-orange fluorescence were readily visible under UV microscopy. In contrast to the green fluorescence of normal nuclei, the yellow-orange fluorescence in cytoplasmic inclusions suggested the presence of a high quantity of ssRNA[7].

8. Bacilliform nuclear viruses with a systemically envelope

In crabs, four distinct enveloped bacilliform viruses with systemic development have been reported: B, B2 viruses from carcinid crabs from the French coastlines, RV-CM from C. maenas from the Atlantic USA coasts (Johnson, 1988), and Baculo-B from C. sapidus from the Atlantic USA Bays (Johnson, 1988). In this group, Johnson's review is still valid, and comparable findings were made in B and B2 viruses in France, as well as RV-CM and Baculo-B in the United States. The envelopes develop during viral assembly before capsid formation and densification, in contrast to the preceding category of systemic enclosed bacilliform nuclear viruses. In terms of size, form, and morphogenesis, these four viruses have a lot in common. Negative staining of isolated particles provided additional information on the viral ultrastructure in this instance as well, especially the surface design of NC and the tail-like structure of enclosed particles. The envelope extension creates a tail-like structure that is changeable in length. One of the NC's extremities is spherical, while the other is blunt and ends in a 15–18 nm thick trilaminar structure. Perpendicular to its long axis, the surface looks crosshatched. This decorative construction is made up of 14 22 nm thick striations made up of stacked rings. These final findings are strikingly similar to those reported for NC and WSSV enclosed particles. In fact, they seem to be morphologically identical. Finally, new results on dot-blot hybridization indicate that shrimp WSSV and at least B2 virus have close connections. According to these findings, the B2 virus may be regarded a WSSV ancestor[8].

9. Prevalence

There are little data on the frequency of enveloped bacilliform nuclear viruses in natural settings. Baculo-A prevalence in C. sapidus collected in the Chesapeake and Chincoteague Bays, on the other hand, ranged from 4% to 20% in various batches, with a mean prevalence of 6% in a total of 1500 crabs tested. Baculo-PP was discovered in two populations of the king crab P. platypus, with a frequency of 40% in Olga Bay in April 1982 and 20% in the Pribilof islands in June 1982. S virus prevalence in the French Mediterranean region C. mediterraneus was very low, seasonally variable, and consistently less than 5%. Only one of 29 crabs taken at Woods Hole tested positive for RV-CV from C. maenas, and this crab was the only one infected out of a total of 74 crabs collected between 1982 and 1983.

Only 19 crabs out of 1500 tested were Baculo-B infected, and seven had been experimentally injected, according to the same author. This emphasizes the scarcity of data on this illness in the natural world. Similar findings were made in France, where B and B2 viruses were discovered in a small number of samples, as well as C. maenas and C. mediterraneus.

10. WSSV and crabs

The economic effect of a potential WSSV-related epizooty in crabs has yet to be determined. However, since the majority of the crabs examined thus far have been shown to be disease-prone, it seems that more monitoring of wild crab populations is required to monitor and potentially prevent WSSV transmission into susceptible wild crabs. Crabs naturally affected with WSSV as well as the findings of experimental WSSV infection of several crab species have been published. The number of potential hosts continues to grow, with 41 crab species being vulnerable to WSSV infection at the moment. 14 species were discovered to be naturally infected, while 27 others were contaminated artificially.

11. Deformities

A failure or delay in mounting from zoea to megaflop owing to the attachment of the residual exoskeleton for many hours during the hatching period results in aberrant swimming behavior and incapacity to ingest feed. The delay or failure of mounting is linked to environmental factors and nutritional deficiency. In grow-out culture, a variety of abnormalities have been seen. Moulting failure, missing legs, abdominal flaps, anomalies of chelate legs, claws, etc. when hard shelled crabs assault the newly mounted crab, aberrant outgrowth, or damage due to different agricultural procedures are only a few examples. All of these characteristics make it easier for opportunistic infections to enter the crab, lowering its market value. Because there is no research including full reliance on artificial food in grow-out culture in India, there is no evidence that nutritional shortages or imbalances cause any illnesses in mud crabs, including minerals, vitamins, and vital fatty acids. In pond-reared juveniles of S. tranquebarica, partial albinism on the carapace and legs has been seen.

12. Other illnesses

In S. serrata, a novel non-infectious shell illness with an unknown origin has been described from Australia. This shell disease's potential to harm mud crab markets has also been observed. This illness is distinguished by irregularly shaped circular lesions known as 'rust spot shell disease,' as well as a distinct histological change. This illness, however, has not been documented in Indian waters. Overcrowding, excessive temperature or pH, low dissolved oxygen, ammonia, and other stressors cause crabs to exhibit symptoms. Once the stressful situation is rectified, the condition is often reversible. Gill blackening may occur as a symptom of a variety of different diseases, including dissolved chemical precipitation, turbidity, and Vitamin C insufficiency. Melanization of tissue and necrosis may cause general darkening of the gills, which can be seen through the side of the carapace. In India, no zoonotic illnesses arising from mud crab have been identified. Vibrio cholera, on the other hand, is a naturally occurring contaminant bacterium found in brackish and estuary waters that has been linked to cholera epidemiology and transmission in the coastal environment. Because crab or crab meat is usually prepared before eating, there is no danger to one's health. However, contamination with germs that may cause human illness can occur during the preparation of crab flesh, therefore food safety standards must be carefully adhered to.

According to a study of the literature, few non-insect invertebrate illness studies satisfy all or some of these criteria. The current study on shell disease in the American lobster, H. americanus, is an exception. Shell illness became a more significant factor than temperature or predation in explaining variations in pre-recruit survival and abundance after 1997, according to Wahle et al. (2009)[9]. The findings were revealed by maintaining parallel time series of different lobster life cycle phases, which allowed researchers to get a better grasp of the pre- and post-settlement processes that affect cohort success. Wahle et al. (2009), on the other hand, were cautious, noting that whereas disease and settlement terms markedly enhanced the model explaining Rhode Island lobster steady decline in the late 1990s, unidentified factors might just have made lobster in southern New England more likely to be subject to disease[4]. The caution is presumably based on the understanding that both host/disease (or parasite) interactions and marine systems are dynamic and in a state of continuous of fluctuation[10].

DISCUSSION

Diseases caused by multiple pathogens in fish and shrimp have been extensively documented, but little is known about their impact on mud crab in hatcheries and farms. Mud crabs are historically thought to be resistant to a wide range of infectious illnesses, however disease incidence under culture conditions is increasing as crab culture becomes more intensive. To improve the production and conservation of mud crab as a sustainable aqua-resource, further study is required to understand the pathogens, hosts, and environmental interactions under hatchery and farming settings. In an aquatic environment, the conventional approach of "stamping out the diseases" is impossible to implement. The movement of live animals between capture/culture sites and market locations is a major aspect of mud crab marketing, with the possibility for disease transmission in situ, enabling the spread to a relatively naive host and/or environment. The fundamental understanding of pathogens in relation to farmed mud crab and how they interact with their hosts falls behind the industry's requirements.

CONCLUSION

As a consequence, it is apparent that systematic methods to disease studies are critical and essential for understanding the impact of illness on fisheries resource availability and distribution patterns. Hematodinium-associated illness poses an unparalleled ecological and fisheries problem in this regard. To my knowledge, no marine invertebrate illness has been regularly seen at high frequency over many decades and is extensively dispersed, impacting numerous commercial and noncommercial crustacean species. However, it is apparent that more systematic and regular monitoring systems are required to keep track of this serious illness. In order to detect disease processes or predictors of illness in field research, such monitoring systems require the adoption or use of inferential statistics. In laboratory studies, larger sample sizes are required to verify field data. Risk assessment studies should be started since the list of vulnerable hosts is expected to increase in the future. Upon the emergence of Hematodinium-associated illness in a previously uninfected area, both oceanographic and human activity should be examined.

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