Coliform contamination of indigenous clam, *Batissa violacea* (Lamarck, 1818) (Bivalvia) in Cagayan River, Philippines: Implications to human health safety

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Introduction

• Recent infectious disease outbreaks caused by the consumption of bivalves contaminated with pathogenic viruses and bacteria has been recognized as a worldwide public health problem (Carlos et al., 2007).

• Bivalves are regarded as potentially hazardous food because of their inherent tendency to bioaccumulate toxic metal through filter feeding (Hatha et al., 2005; Adjei-Boateng et al., 2009).
Introduction

• Land Use Change: growing urban development in region 02 (Rimando, 2003)
• 3 cities (Tuguegarao, Santiago and Cauyan)
• 2007 - 3.05 M (114 persons/km2)
• 2020 - 3.15 M 2020 (Cagayan Valley Regional Development Plan 2011-2016).
Introduction

• Previous incident of pollution (Coliform Bacteria) in the Cagayan River waters due to discharge of untreated wastes by residences and buildings (http://www.dpwh.gov.ph).

• Limited available studies on coliform concentration test of fishes and mollusks from Cagayan River.
Objective

Determine the levels of total coliform and *E. coliform* contamination in the flesh of *B. violacea* and its riverine water.
Materials and Methods
Study Area

Station 1 = Aguiguican, Gattaran;  
(18° 6’10.98” N – 121° 39’20.48” E)

Station 2 = Sta. Maria, Lallo;  
(18° 8’16.84” N – 121° 39’50.29” E)

Station 3 = San Lorenzo, Lallo;  
(18° 9’5.93” N – 121° 39’13.38” E)

Station 4 = Catayuan, Lallo;  
(18° 10’11.89” N – 121° 39’5.72” E)

Station 5 = Tucalana, Lallo;  
(18° 11’16.97” N – 121° 39’33.62” E)

Station 6 = Jurisdiction, Camalaniugan.  
(18° 14’40.53” N – 121° 40’22.87” E)
Collection of *B. violacea* samples
Water sampling and analytical method

River water samples

Freezing/Icing

DOST Region 02 Laboratory
Total Coliform (TC) and *E. coli* (EC) analysis in *B. violacea*
Results and Discussion
Table 1. Comparison of coliform count (T.C and *E. coli*) of harvesting areas of *B. violacea* to different standard acceptable coliform levels

<table>
<thead>
<tr>
<th>STATION/COUNTRY/INSTITUTION</th>
<th>TOTAL COLIFORM COUNT (MPN/100 ML)</th>
<th>ESCHERICHIA COLI COUNT (MPN/100 ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station 1</td>
<td>&gt; 8.0</td>
<td>&gt; 8.0</td>
</tr>
<tr>
<td>Station 2</td>
<td>&gt; 8.0</td>
<td>&gt; 8.0</td>
</tr>
<tr>
<td>Station 3</td>
<td>&gt; 8.0</td>
<td>&gt; 8.0</td>
</tr>
<tr>
<td>Station 4</td>
<td>&gt; 8.0</td>
<td>&gt; 8.0</td>
</tr>
<tr>
<td>Station 5</td>
<td>&gt; 8.0</td>
<td>&gt; 8.0</td>
</tr>
<tr>
<td>Station 6</td>
<td>&gt; 8.0</td>
<td>&gt; 8.0</td>
</tr>
<tr>
<td>Mean station</td>
<td>&gt; 8.0</td>
<td>&gt; 8.0</td>
</tr>
<tr>
<td>DENR Administrative Order (DAO), 1990</td>
<td>5000</td>
<td>-</td>
</tr>
<tr>
<td>DENR Administrative Order (DAO), 2008</td>
<td>-</td>
<td>200*</td>
</tr>
<tr>
<td>European Union (EU)</td>
<td>-</td>
<td>14 and below*</td>
</tr>
<tr>
<td>United States (US)</td>
<td>-</td>
<td>14 and below*</td>
</tr>
<tr>
<td>United Nations Environment Program (UNEP)</td>
<td>-</td>
<td>10 and below for 80% of samples*</td>
</tr>
<tr>
<td>World Health Organization (WHO)</td>
<td>-</td>
<td>10 and below for 80% of samples*</td>
</tr>
<tr>
<td>Wider Caribbean Region (WCR)</td>
<td>-</td>
<td>43*</td>
</tr>
<tr>
<td>Iceland</td>
<td>-</td>
<td>14 and below*</td>
</tr>
</tbody>
</table>

Source: Modified from Owili, 2003

Note: * = Fecal coliform

Station 1=Aguiigan, Gattaran; Station 2=Sta. Maria, Lallo; Station 3=San Lorenzo, Lallo; Station 4=Catayuan, Lallo; Station 5=Tucalana, Lallo; Station 6=Jurisdiction, Camalaniugan.
Table 2. Comparison of coliform count (T.C and *E. coli*) of *B. violacea* flesh tissues to different standard acceptable coliform levels.

<table>
<thead>
<tr>
<th>COLIFORM</th>
<th>B. VIOLacea IN CAGAYAN RIVER</th>
<th>PHILIPPINE FDA CIRCULAR NO. 2013-010</th>
<th>EUROPEAN UNION (EU) CATEGORY (a)</th>
<th>ENVIronmeNT CANADA (EC) (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Coliform count (MPN/g)</td>
<td>&gt; 1100 MPN/g</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Escherichia coli count (MPN/g)</td>
<td>&gt; 1100 MPN/g</td>
<td>16 MPN/ g</td>
<td>&lt;230 MPN/100 g</td>
<td>&lt;4,600 MPN/100 g</td>
</tr>
</tbody>
</table>

Note:
*(b)= Oyster meat samples (Sonier et al., 2006)*
Conclusion

• High concentration of TC and *E. coli* (>1,100 MPN/g) in the meat of the *B. violacea* could be explained by the underlying sediments of the bivalve.

• The *B. violacea* could possibly ingests the bacteria since it is a filter feeder bivalve that burrows to the sediment at a considerable depth (Thangavelu et al., 2011).
Cagayan River Basin to put control mechanisms in place to prevent the pollution in the river waters and bacterial contamination in the *B. violacea* and other fishery resources of the river.

- Depuration of the clam in clean running water to reduce the bacterial load to acceptable levels.
- Thorough cooking of the clam before consumption.
**Recommendation**

- IEC campaign on the importance of depuration as a means of decontaminating the clams should be incorporated into the general shellfish fishery management in the region.

- A study to test the potentially pathogenic contamination to hazardous levels by *B. violacea* sold in the wet markets in the region.

- A study to analyse possible contamination of *B. violacea* in the river and wet markets to heavy metals.
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Thank you for Listening!