

四種重金屬鹽浸浴小鰻引起組織病變之研究

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Histopathological Responses Study of Four Heavy Metallic
Salts to Bath Glass Eel, *Anguilla japonica*.

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Glass eel (*Anguilla japonica*) are exposed to metallic salts zinc sulfate, cadmium chloride, copper chloride every with 0.5ppm and mercuric chloride with 0.01ppm bath for 96 hours. By means of the treatments to induce histopathological responses are studied. The results are as follows: Eel exposed to zinc, some rod and spicule like crystals in many tissues are found; to cadmium, kidney is dominantly destroyed; to mercury, liver is significantly damaged; to copper, kidney, liver, pancreas and gills are all damaged.

The authors think the toxic degree of these metals to glass eel copper is the first, cadmium is the second and zinc is the third, mercury with different concentration can't compare.

前 言

自1950年代日本的「水俣」發生水銀中毒引起可怕之神經症以來，重金屬威脅人類健康問題開始受重視。而臺灣亦由於近幾年來工業急速成長，工業廢水污染河川，農地普遍使用農藥導致水污染的問題日趨嚴重，為保障國民健康增進人類福祉，及提高對重金屬污染造成水族的危害有進一步了解起見，進行此項試驗，以供訂定養殖用水標準，工廠排廢水管制，魚類品質檢驗及作比較病理學之參考。

有關重金屬鋅 (Zinc)，鎘 (Cadmium) 汞 (Mercury) 及銅 (Copper) 對水族生物的影響之研究，國外已有頗多的報導，諸如1970, GEORGE R. GARDNER報導海灣魚對鎘之血液學及組織學上的反應。1971, H. WINDOM等調查北大西洋35種魚類之砷、汞、銅、鋅之含量情形。E. BILINSKI及R. E. E. JOANS亦曾報導以氯化鎘 (CdCl₂) 及氯化銅 (CuCl₂) 處理鱒 (rainbow trout) 其鰓部之乳酸lactate氧化率50%受抑制，以前者處理虹鱒的鰓薄板呈癒合狀並有很多細胞碎片堆積，而以後者處理之虹鱒其鰓薄板上皮細胞呈現分離現象。1973, KENNETH藉組織掃描配合電子顯微偵測研究虹鱒的鰓對水銀的吸收，發現鰓軟骨含高濃度之水銀。1973, KENNETH以甲基汞對魚的紅血球有良好的親和性40分鐘可吸收90%，而無機汞只9%，但若以林格氏液或水洗其吸收可增至65%。1973, H. C. FREEMAN 調查美國鰻之汞及甲基汞含量，其濃度均在0.5PPM以下被認為可供食用。1973, GEORGE R. GARDNER以銅誘導海灣魚使其發生病變。臺灣1980，陳等報導汞在鯽魚 (*Carassius carassius*) 體內之蓄積與排出。此外1972, JOHN E. HALVER, 1975, WILLIAM E. RIBELIN, 1975, KOEMAN及STRIKE等都針對重金屬對水族生物的影響組織病理等研究曾編書供參考。由此可知深受全世界之重視與關切。

本試驗係以研究鋅、鎘、汞、銅浸浴小鰻(0.65 g)，就其急性毒對小鰻組織病變之結果及作討論

材料及方法

小鰻(0.65g)分4組以鋅、鎘、銅0.5 PPM 及汞0.01PPM 浸浴 96 小時後每組取 5 尾活鰻，以 Bouin's 液固定，石腊包埋做成 5 μ 切片，以 Haematoxylin 及 Eosin 染色並做 PAS 反應試驗，以顯微鏡觀察其結果。

結 果

鋅 (Zinc) 對小鰻之組織危害發生很多針狀或桿形晶物於組織中。如 Plate 1 Fig. 1 皮下疏松結締組織出現結晶物。Fig. 2 結晶物之放大圖。Fig. 3 在粘液細胞內所發現之結晶物。Fig. 4 鰓部的軟骨組織內所發現之結晶物。在小鰻之鰓上皮細胞則有輕微過形成反應，而內臟各器官無顯著病變。

鎘 (Cadmium) 較顯著的病變在小鰻的腎臟，其細尿管上皮細胞出現大量硝子滴變性 (hyaline drops degeneration) 如 Plate 2 Fig. 1 病變進行較速者。細尿管呈現壞死或溶解消失如 Fig. 3。以鎘處理之上皮細胞，有很多壞死病巢如 Fig. 4。

汞 (Mercury) 對小鰻肝臟造成較顯著之影響而引起肝炎 (hepatitis)，血管周圍大都有炎性細胞浸潤 (Wandering cell infiltration) 如 Plate 3 Fig 1。肝細胞呈點狀 PAS 陽性反應。鰓之呼吸上皮細胞有過形成反應。有些組織如肌肉亦發現結晶物。

銅 (copper) 之顯著病變在腎臟，很多細尿管上皮細胞呈現凝固壞死 (Coagulative necrosis)，排列成構狀如 Plate 3 Fig 2。鰓部出現過形成反應成棍棒化如 Fig 3。肝、胰之實質細胞變性或壞死。

討 論

依本試驗的結果得知小鰻經鋅、鎘、汞、銅處理所引起的影響，就組織反應有差異及相同者。可依其主要差異分別如下：

- (1) 鋅及汞會產生結晶於組織或器官，惟鋅不產生肝炎，而汞則有顯著肝炎發生。
- (2) 鎘與銅處理後，鎘之主要病變在腎臟而其他器官並不明顯，而銅除腎之病變外鰓、胰、肝均有顯著之病變，同時鎘處理腎小管呈點狀，硝子滴變性及核壞死腎小管崩解消失較為明顯。而銅則腎小管凝固壞死，且壞死細胞呈長錐形而非點狀。故可由急性毒組織病變分辨為何種金屬中毒。

由組織變化情形判斷其毒性 $Cu > Cd > Zn$ ，汞由於取樣時濃度較低無法由病變化判斷。依病變結果推測汞在小鰻是肝內堆積較多，而鎘與銅是在腎較多，鋅則內臟堆積很少。由此試驗得知硫酸銅對小鰻是相當有危害性，故在魚病防治使用上應多加注意免生意外。

摘 要

本研究係針對四種金屬鋅 (Zinc)、鎘 (Cadmium)、汞 (Mercury)、銅 (Copper) 等，汞 0.01 PPM，其餘為 0.5 PPM 浸浴小鰻 (0.65 g 大小) 96 小時誘導其發生病變之結果。(1) 鋅在全身產生針狀或桿形結晶。(2) 鎘主要病變在腎臟，造成腎小管之硝子滴變性及壞死。同時腎小管壞死後之核碎片常遺留，另外鰓上皮破裂剝損。(3) 汞則引起鰓部之過形成反應及嚴重的肝炎 (hepatitis)。(4) 銅引起鰓部之過形成反應及局部肝細胞變性，胰細胞及腎小管上皮細胞凝固壞死。

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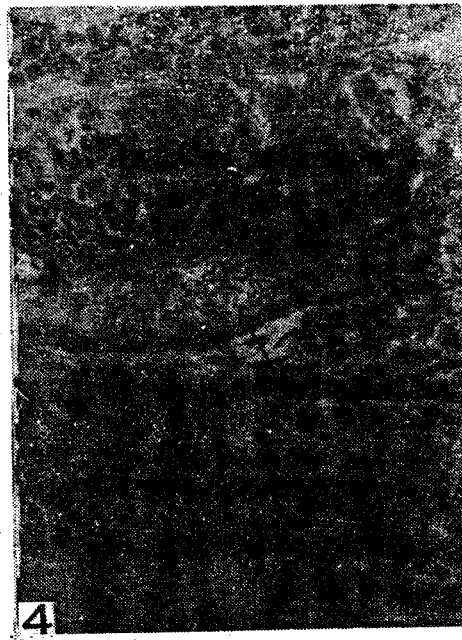


Plate 1 :

1. Some crystals are appeared in dermal loose connective tissue of glass eel to zinc exposure. H-E stain X 100
2. Magnified subdermal crystals. H-E stain X 400
3. Some rod-crystals appearing in mucous cells are found. H-E stain X 400
4. Some spicule like crystals in gill cartilage are found. H-E stain X 400

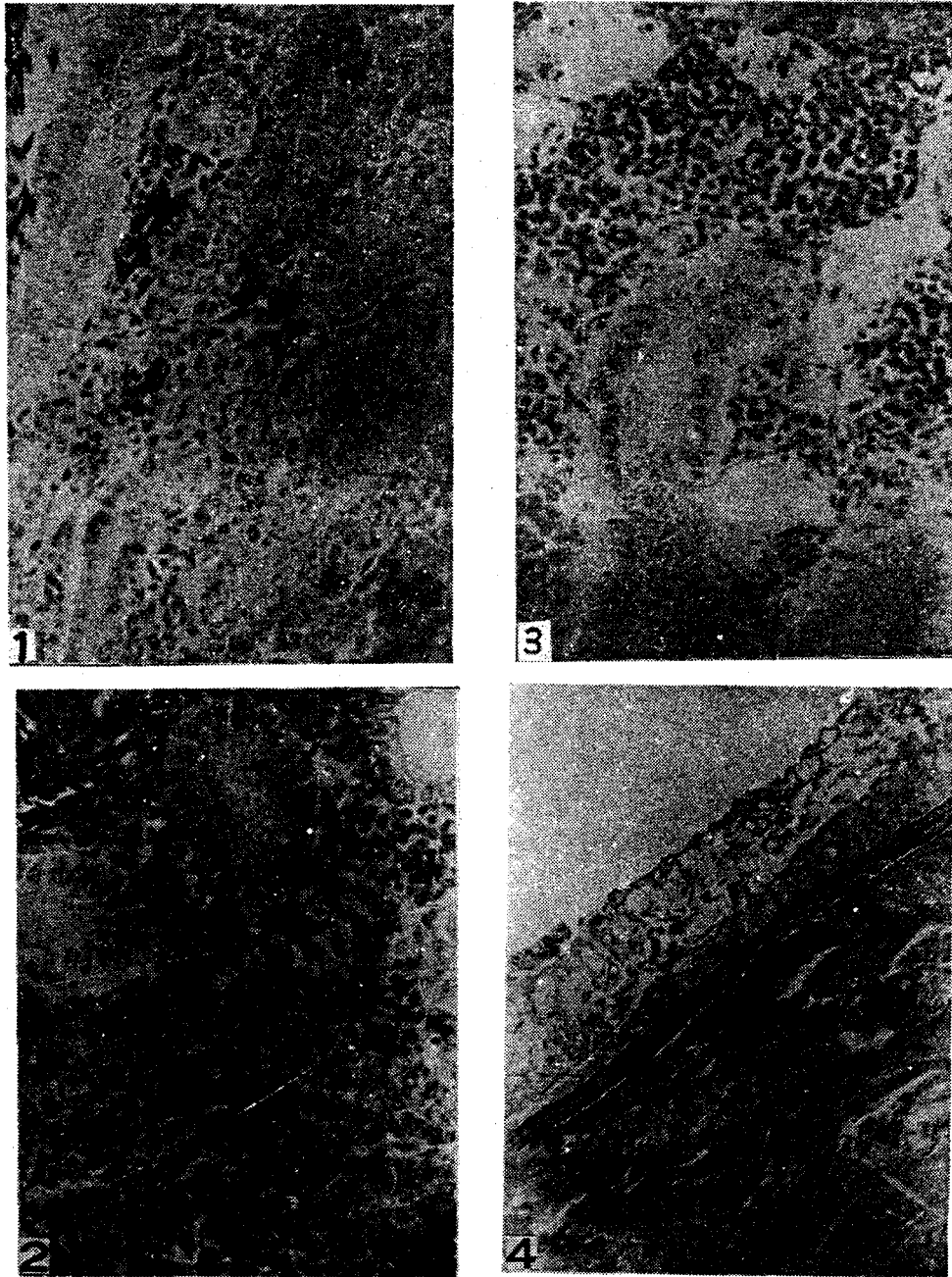


Plate 2 :

Hyaline drops degeneration are found in glass eel to cadmium exposure H-E stain X 400

Some karyorrhexis debris found in necrotic renal tubule. H-E stain X 400

Renal tubule epithelial cells necrosis only some architecture left. H-E stain X 400

Exposed cadmium chloride to glass eel appeared some parts of epidermis corrosion and necrosis. H-E stain X 100

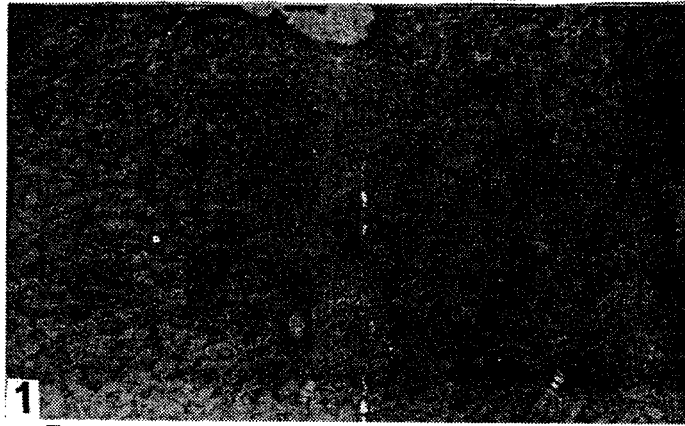


Plate 3 :

1. Wandering cells infiltration around a vein of liver of glass eel to mercury exposure. H-E stain X 100
2. Renal tubule epithelial cells coagulative necrosis are found in glass eel to copper exposure. H-E stain X 400
3. Severely hyperplasia of gill respiratory epithelium are found in glass eel to copper exposure. H-E stain X 100