



NOTA CIENTÍFICA

Malformation in the crab *Ucides cordatus* (Linnaeus, 1763) (Crustacea, Brachyura, Ocypodidae), in São Vicente, State of São Paulo, Brazil.

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Resumo. Malformação no caranguejo *Ucides cordatus* (LINNAEUS, 1763) (Crustacea, Brachyura, Ocypodidae), em São Vicente, (SP), Brasil. Na década de 70 a Baixada Santista foi alvo de expressiva contaminação ambiental proveniente de toneladas de resíduos das mais diversas atividades, particularmente industriais, liberadas sem qualquer tratamento e em locais inadequados, acarretando na poluição do ar, solo e água. Um exemplar macho de *U. cordatus* (LC = 75,7mm; PE = 180,9g) foi capturado em um dos manguezais de São Vicente (SP) apresentando malformação do dedo fixo de seu própodo quelar maior (esquerdo), o qual foi substituído por uma estrutura em formato de garra. Possivelmente o animal sofreu perda do dedo fixo do própodo quelar em confronto com outro espécime, com surgimento de uma estrutura com cinco extremidades. Esta malformação pode ocorrer esporadicamente na natureza, bem como em experimentos conduzidos em laboratório por estresse ambiental. O espécime apresentou alta incidência de células micronucleadas na hemolinfa (11,5±2 células micronucleadas/1.000 analisadas), aproximadamente três vezes mais alta do que os valores considerados normais (<4/1.000 células). Este resultado é causado pelo expressivo impacto antropogênico nesta área estuarina, sujeita a diversas fontes de poluição (lixões públicos da Alemoa/Sambaiatuba e o Pólo Industrial de Cubatão), que certamente afetam o desenvolvimento o ciclo de vida dos invertebrados aquáticos. Neste sentido, é muito importante a intensificação de estudos nesta área pelo uso do método aqui empregado, visando uma avaliação mais ampla dos problemas ambientais existentes e sua influência sobre os organismos estuarinos.

Palavras-chave: Caranguejo, Genotoxicidade, Lixão, Manguezal, Micronúcleo, Poluição.

Abstract. In the seventies, the region known as Baixada Santista was a large repository of environmental contamination mainly resulting from industrial waste. In effect, the contaminated residues came from different toxic substances including chemical, biochemical and others. Industrial waste was dumped or even stored in inadequate fragile ecological sites without any previous treatment and it resulted in significant amounts of air, soil and water pollution. A male specimen of *U. cordatus* (CW = 75,7mm; W = 180,9g) presenting a malformation of the pollex (immovable finger) of its major claw (left) was captured in São Vicente city (State of São Paulo, Brazil), raising concern to the local press and community. The im-

movable finger of the propodus segment in the claw of this specimen was modified into a structure in the form of a talon. This structure resembling an avian claw was comprised of five fixed ends united at the base. This might be a result from an injury of the original corpus structure while in a confrontation with another specimen. The newly found sample showed a high incidence of micronucleated cells in the haemolymph (11.5 ± 2 micronucleated cells/1,000 analyzed cells), approximately three times higher than normally reported ($<4/1,000$ cells). Perhaps this suggests the effect of an environmental influence in the morphology of the organism, most likely linked to the several sources of pollution in the region (public dump of Alemoa/Sambaiatuba, and the industrial conglomerate of Cubatão). We propose that similar measurements could be used in the estuarine area to assess and evaluate ecological risks and adverse biological effects.

Key words: Crab, Genotoxicity, Public Dump, Mangrove, Micronuclei, Pollution.

Ucides cordatus (Linnaeus, 1763) is a crab species of great importance, endemic to mangroves. It processes senescent leaves available on the sediment and it is an essential component in some nutrient cycles (WOLFF *et al.* 2000, KOCH & WOLFF 2002). In recent years, this species has been under intense predation as food for human consumption in Brazil, particularly in the Northern (ISAAC-NAUM 2006) and Northeastern regions (IVO *et al.* 1999, 2000), where it is an important source of income for traditional communities (FISCARELLI & PINHEIRO, 2002). A male adult specimen of this species, measuring 75.7mm of carapace width (CW) and weighting 180.9g (W), was captured by a local resident in the banks of an estuarine canal from the Jockey Clube district, in São Vicente, State of São Paulo ($23^{\circ}56'16,2''S$ - $46^{\circ}23'32,9''W$). The unusual malformation of the cheliped motivated the collector of the crab to keep it alive and report his finding to the local press. A local newspaper ("Expresso Popular") contacted us to examine the specimen when a malformation of the immovable finger of the propodus from the left major claw was noticed. Instead of the expected single immovable finger connected to a moveable one (Fig. 1-A), we found five ends with the same morphology, but united at the base forming a hand-like structure (Fig. 1-B). In

a detailed inspection of the malformation, the existence of a scar under the exoskeleton was observed. The scar was easily identifiable due to the lower calcification and the translucent aspect of the wound. Possibly, the animal suffered a severe mechanical injury while interacting with another specimen of this species, which caused the wound or loss of the cheliped pollex. This probably happened due to a confrontation with another male of the species during the "andada" (which loosely translated means "wandering or shopping around") given this animal was found far from its vegetation niche after crossing the channel. This agonistic behavior between adult males is common in crabs due to territoriality, and it is particularly strong during the reproductive activities (PINHEIRO & FRANSOZO 1999, MARIAPPAN *et al.* 2000), mainly in *U. cordatus* (GÓES *et al.* 2000). It is possible that the specimen's wound became susceptible to contamination and excessive loss of haemolymph following an extensive injury. Injuries of such extent and nature may cause abnormalities in the chelipeds, as described by OKAMOTO (1991) of the deep sea crab *Geryon affinis* (Edwards A.M. & Bouvier, 1894). Abnormalities have been induced in laboratory experiments with *Procambarus clarkii* (Girard, 1852), originated from aberrant regeneration of local nerves, which develops

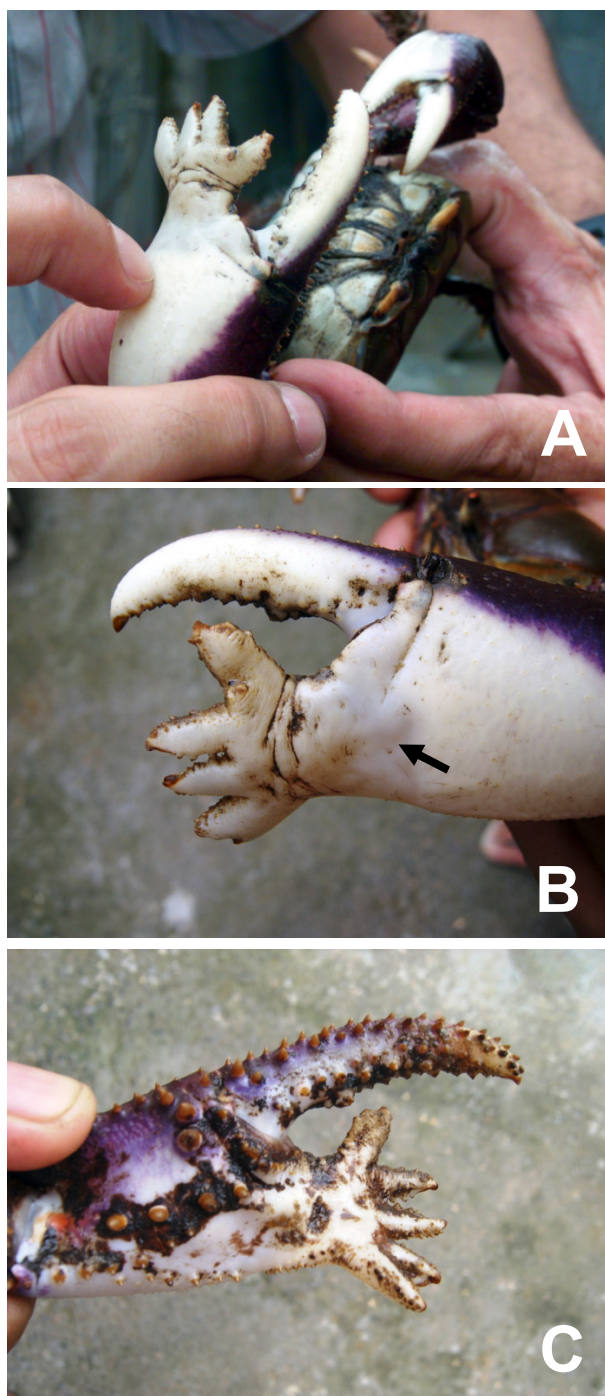


Figure 1. *Ucides cordatus* (Linnaeus, 1763). Male, adult specimen collected in São Vicente (São Paulo), showing malformation of the immovable finger of the propodus in major cheliped (A, overall view of the specimen showing the malformation of the left cheliped in comparison to the normal right one; B-C, Close view of the malformation in the propodus of the left cheliped in internal and external view, respectively). Arrow = "scar" on the exoskeleton evidencing the location of the mechanic injury.

into a radicular form and elongates, giving rise to extra claw or dactylus (NAKATANI *et al.*, 1998). In addition, malformation may be the result of stress due to inappropriate environmental conditions. A sample of the haemolymph was taken for the analyses of micronucleated cells for further investigation. The haemolymph sample was extracted with a syringe (21 gauge) inserted at the articulated membrane between the carpus and the propodus of the major claw. The haemolymph was dropped into three slides to prepare a smear, dried at room temperature (20-30 min) and dehydrated in Methanol Absolute (6-8 min). The samples were dyed in a 5% Giemsa solution, in a pH 8.0 phosphate buffer ($\text{Na}_2\text{HPO}_4 + \text{KH}_2\text{PO}_4$) for 20 min. Following that, the slides were washed in deionized water and dried at room temperature. Using a microscope coupled with an image analysis system (KS-300[®] Software - Carl Zeiss), 2,000 cells were inspected for the presence of micronuclei in each slide and the frequency of micronucleated cells/1,000 cells (FMN) calculated. The specimen showed a FMN ranging from 9.5 to 13.5/1,000 cells, with mean of 11.5 ± 2 micronucleated cells/1,000 analyzed cells, approximately three times higher than values reported as normal (FMN < 4/1,000 cells, according to SCARPATO *et al.* 1990 and FOSSI *et al.* 2000). This suggests that this organism was subjected to intense stress caused by environmental adverse effects. In the seventies, the region known as Baixada Santista was a large repository of environmental contaminated waste resulting from tons of residues derived from many different sources, mostly from industries in the area. Industrial waste was dumped anywhere indiscriminately, mostly in ecologically fragile sites, without any previous kind of treatment and it resulted in very significant amounts of air, soil and water pollution. The area where this specimen was collected is located very close to two public dumps (Alemoa and Sambaiatuba) and an important Industrial conglomerate (Cubatão). There is a great diversity of

chemical pollutants occurring in this estuarine area. Previous studies reveal a significant water contamination by Arsenic, Manganese and Phenol (CETESB 2001) and sediment contamination by Cadmium (DENIS ABESSA unpublished work), Mercury (SIQUEIRA *et al.* 2005), and hydrocarbon products (CESAR *et al.* 2006). It is known that sufficiently high intensity exposure to single chemicals can produce mutation in animals. This fact is maximized in this specific area because it involved simultaneous and multiple types of adverse environmental exposures capable of originating malformations. This region was considered once one of the most polluted in the world (VIOLA 1987), and despite policies and actions from environmental agencies, mutations are still observed in various animals, particularly in aquatic invertebrates (BRUNETTI *et al.* 1998, WRISBERG *et al.* 1992). It is our thought that the intensification of studies in this area with the same methodology used in this study is of utmost importance for a broader evaluation of the current ecological risks we face and their consequence for the morphology of estuarine life.

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