

# Pengaruh 6-Paradol terhadap Kerusakan Ultrastruktur serta Aktivitas Asetilkolinesterase, Glutation-S-Transferase, dan Sitokrom C-Oksidase pada *Pediculus humanus capitis*: Studi Eksperimental In Vitro = Effects of 6-Paradol on Ultrastructural Damage and Acetylcholinesterase, Glutathione-S-Transferase, and Cytochrome C-Oxidase Activity in *Pediculus humanus capitis*: In Vitro Experimental Study

Rachmanin Aldilla, author

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## Abstrak

Infestasi *Pediculus humanus capitis* banyak terjadi di negara berkembang namun masih terabaikan. *P. h. capitis* telah menjadi resisten terhadap insektisida umum di dunia. Sebagai alternatif, diperlukan senyawa aktif yang berasal dari ekstrak tanaman yang dapat memberantas infestasi *P. h. capitis*. Penelitian ini bertujuan untuk mengevaluasi toksisitas in vitro 6-paradol terhadap *P. h. capitis* dan mendeskripsikan mekanisme toksisitas tersebut yang dimediasi oleh pengamatan aktivitas enzim detoksifikasi dan perubahan ultrastruktur *P. h. capitis*. Stadium dewasa *P. h. capitis* dipaparkan dengan kertas filter yang ditetesi larutan 6 paradol (0,5; 1,0; 1,5 ppm) dan permethrin (1%). Perubahan ultrastruktur *P. h. capitis* diperiksa dengan scanned electron microscope (SEM). Bioassay in vitro dilakukan selama 10, 20, 30, dan 60 menit. Aktivitas asetilkolinesterase (AChE), glutathione-S-transferase (GST), sitokrom C-oksidase (COX) dianalisis menggunakan metode CDC (Centers for Disease Control). Berdasarkan hasil penelitian, 6-paradol menyebabkan kerusakan yang serius (bentuk kepala, toraks, abdomen tidak normal, kerusakan spirakel di bagian abdomen, kerusakan lapisan kitin, serta kerusakan rambut sensori). Permethrin tidak menyebabkan perubahan ultrastruktur yang berarti. 6-paradol memperlihatkan toksisitas yang lebih tinggi dibandingkan dengan permethrin. 6-paradol meningkatkan aktivitas AChE, GST dan COX. Permethrin meningkatkan aktivitas AChE, GST, dan COX. 6-Paradol bersifat lebih toksik dan lebih merusak ultrastruktur *P. h. capitis* dibandingkan permethrin melalui peningkatan aktivitas AChE, GST, dan COX.

.....*Pediculus humanus capitis* infestation happens a lot in some developing country but still neglected. *P. h. capitis* has become resistant to common insecticides worldwide. As an alternative, bioactive compound from plant extracts are needed so that it can eradicate *P. h. capitis*. This study aims to evaluate the in vitro toxicity of 6-paradol against *P. h. capitis* and to describe the mechanism of the toxicity which mediated by detoxification enzymes activity and changes in the ultrastructure of the headlice. Adult stage of *P. h. capitis* were exposed to filter paper that has been dripped with 6-paradol (0.5, 1.0, 1.5 ppm) and permethrin (1%). Ultrastructural changes *P. h. capitis* was examined with scanned electron microscope (SEM). In vitro bioassays were performed for 10, 20, 30, and 60 minutes. The activities of acetylcholinesterase (AChE), glutathione-S-transferase (GST), and cytochrome C-oxidase (COX) were analyzed using the CDC (Centers for Disease Control) method. As a result, 6-paradol caused serious damage (abnormalities in head, thorax, and abdomen, spiracle damage in the abdomen, chitin layer damage, and sensory hair damage). Permethrin did not cause significant ultrastructural changes. 6-paradol showed higher toxicity than permethrin. 6-paradol increases the activity of AChE, GST, and COX. Permethrin increases AChE, GST, and COX activity. 6-paradol is more toxic and causes more damage in the ultrastructure of *P. h. capitis* than permethrin by increasing the activity of AChE, GST, and COX.