



Original Article

Wallacea: Tropical Biomedicine Journal



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Potential of Chinese Ketepeng Leaf Infusion (*Senna alata* L. Roxb.) on Cercaria Mortality

Potensi Infus Daun Ketepeng Cina (*Senna alata* L. Roxb.) Terhadap Mortalitas Serkaria

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Abstract.

Introduction: Trematodiasis is a disease caused by infection with trematode worms, in which cercariae act as the infective larval stage released from snails as intermediate hosts and remain a public health problem in tropical regions, including Indonesia. Control of cercariae in aquatic environments is essential, one of which can be achieved through the use of traditional medicinal plants such as ketepeng cina leaves (*Senna alata* L. Roxb.), which contain bioactive compounds including flavonoids, saponins, tannins, and anthraquinones with potential antiparasitic properties. **Objective:** This study aimed to determine the potential of ketepeng cina leaf infusion in reducing cercarial mortality and to identify the most effective concentration. **Methods:** This study employed a true experimental design with a posttest-only control group design using five treatment groups, consisting of three infusion concentrations (0.5%, 1%, and 2%), one negative control, and one positive control (praziquantel). Each group contained five cercariae, and observations were conducted at the 1st, 2nd, 4th, and 6th hours. Statistical analysis was performed using the kruskal-wallis test followed by the mann-whitney test. **Results:** Ketepeng cina leaf infusion (*Senna alata* L. Roxb.) showed potential in increasing cercarial mortality, with the 2% concentration being the most effective compared to the 0.5% and 1% concentrations. The effectiveness of the infusion was influenced by concentration and exposure time and was characterized by paralysis and morphological damage to the cercariae. **Conclusions:** Ketepeng cina leaf infusion (*Senna alata* L. Roxb.) has the potential to increase cercarial mortality, with the 2% concentration identified as the most effective. Although the effect was not fully statistically significant, these findings indicate the potential of ketepeng cina leaf infusion as a cercarial control agent.

Keywords: *Senna alata*; cercariae; mortality

Abstrak

Pendahuluan: Trematodiasis merupakan penyakit yang disebabkan oleh infeksi cacing trematoda, serkaria berperan sebagai stadium larva infeksi yang dilepaskan dari keong sebagai hospes perantara. Penyakit ini masih menjadi masalah kesehatan Masyarakat di berbagai wilayah tropis termasuk Indonesia, khususnya pada daerah rawa dan Sungai yang mendukung perkembangan keong sebagai inang parasit. Pengendalian serkaria di lingkungan perairan sangat penting untuk mencegah penularan penyakit. Salah satu alternatif

pengendalian hayati adalah pemanfaatan tanaman obat tradisional yang memiliki potensi antiparasit, seperti daun ketepeng cina (*Senna alata* L. Roxb.) yang diketahui mengandung senyawa bioaktif antara lain flavonoid, saponin, tanin, dan antrakuinon. **Tujuan:** Penelitian ini bertujuan untuk mengetahui potensi infusa daun ketepeng cina dalam menurunkan mortalitas serkaria serta menentukan konsentrasi yang paling efektif. **Metode:** Jenis penelitian yang digunakan adalah true experimental dengan rancangan *posttest only control group* design menggunakan lima kelompok perlakuan, yaitu tiga konsentrasi infusa (0,5%, 1%, dan 2%), satu kontrol negatif, dan satu kontrol positif (paraziquantel). Setiap kelompok terdapat 5 serkaria dengan 3 kali pengulangan dan dilakukan pengamatan pada jam ke-1, ke-2, ke-4, dan ke-6. Analisis statistik dilakukan menggunakan uji kruskal-wallis dan dilanjutkan uji mann-whitney. **Hasil:** Infusa daun ketepeng cina memiliki efek larvasidal terhadap serkaria. Efektivitas tertinggi diperoleh pada konsentrasi 2% dengan rata-rata mortalitas 93,33%, meningkat secara bertahap seiring peningkatan konsentrasi dan waktu pajanan. **Kesimpulan:** Infusa daun ketepeng cina (*Senna alata* L. Roxb.) berpotensi sebagai agen pengendalian hayati serkaria, dengan konsentrasi 2% memiliki efektivitas paling tinggi dalam menyebabkan mortalitas serkaria.

Kata kunci: *Senna alata*; serkaria; mortalitas

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doi: xxxxx

Article history: Received 12 December 2025; Revision 18 January 2026; Accepted 11 February 2026; Available online 28 February 2026

1. Introduction

Cercariae are the infective larval stage of trematodes and play a crucial role in the transmission of trematodiasis to humans. Eggs excreted in human feces or urine hatch in aquatic environments into miracidia, infect freshwater snails as intermediate hosts, and develop into sporocysts, rediae, and finally cercariae, which infect humans through the

consumption of raw food or direct skin contact with contaminated water. Trematodiasis is a group of parasitic diseases caused by trematodes affecting multiple organs, including the liver, lungs, blood, pancreas, and intestines, and according to the (Organization, 2021), it has been reported in more than 70 countries, with approximately 90 million cases worldwide as reported by (Li et al., 2024), while cases of *Fasciolopsis buski* infection in humans were first reported in Indonesia in 1982 in Hulu Sungai Utara Regency, South Kalimantan. The presence of diverse cercarial types in freshwater snails has been widely reported, including *echinostome* and *furcocercous cercariae* documented by Chontanarith et al. (2017) in Thailand and by (Hairani, B., Annida, A., Hidayat, S., & Fakhrizal, 2020) and (Jabal, Akbar, et al., 2022) in Kalimantan. The ecological characteristics of Selat Subdistrict, Kapuas Regency, Central Kalimantan, dominated by rivers, swamps, and irrigation canals, provide ideal habitats for snails as trematode intermediate hosts, highlighting the need for cercarial control through the use of plants with potential inhibitory effects on infective larval development.

Ketepeng cina (*Senna alata* (L.) Roxb.) contains various bioactive compounds with antimicrobial, antioxidant, and antiparasitic activities, including anthraquinones, flavonoids, phenolic compounds, saponins, and tannins. (Angelina et al., 2021) reported that leaf extracts of *Senna alata* collected from several regions in Indonesia contained flavonoids, alkaloids, saponins, tannins, and triterpenoids. Studies conducted in the Kalimantan region further demonstrated that *Senna alata* leaves are rich in phenolic compounds, flavonoids, saponins, and tannins with antibacterial properties. Pharmacologically, *Senna alata* has been traditionally used as a laxative, an anthelmintic, an antipruritic agent, and for the treatment of skin disorders caused by parasitic infections. Previous studies on ketepeng cina (*Senna alata* (L.) Roxb.) have predominantly focused on its antibacterial, antiparasitic, and antiprotozoal activities.

Studies conducted in Ghana demonstrated antibacterial effects of ketepeng cina extracts against *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Klebsiella pneumoniae*, (Seng Chiew Toh, Samuel Lihan, 2023) reported that ethyl acetate extracts of ketepeng cina effectively inhibited *Staphylococcus aureus*. In addition, *Senna alata* (L.) Roxb. extracts exhibited protective and anti-inflammatory activity against *Eimeria spp.* in livestock coccidiosis, and Dente et al. reported significant anthelmintic effects against adult *Haemonchus contortus* and *Paramphistomum gracile* in studies conducted in Burkina Faso (2019 2020) and Nigeria (2022). Furthermore, research at Universitas Sam Ratulangi, Manado demonstrated that *Senna alata* (L.) Roxb. leaf infusion induced paralysis in *Ascaris lumbricoides*. Therefore, this study aims to assess the potential of Ketepeng cina (*Senna alata* (L.) Roxb.) leaf infusion as a biological control agent to reduce cercarial viability and transmission risk, offering an environmentally friendly and sustainable approach for trematodiasis control in endemic aquatic ecosystems.

2. Methods

This study employed a true experimental design using a posttest-only control group design to evaluate the effect of *Senna alata* (L.) Roxb. leaf infusion on cercarial mortality. The experiment was conducted under laboratory conditions with five treatment groups, consisting of three infusion concentrations (0.5%, 1%, and 2%), a negative control (without treatment), and a positive control using praziquantel. Observations were performed at 1, 2, 4, and 6 hours after treatment. The study population comprised all cercariae obtained from freshwater snails collected in Selat Subdistrict, Kapuas Regency, Central Kalimantan, Indonesia. Samples consisted of live cercariae that met the inclusion criteria and were selected using a purposive sampling technique. *Senna alata* leaves were taxonomically authenticated at the Herbarium Bandungense, Institut Teknologi Bandung (ITB), Indonesia.

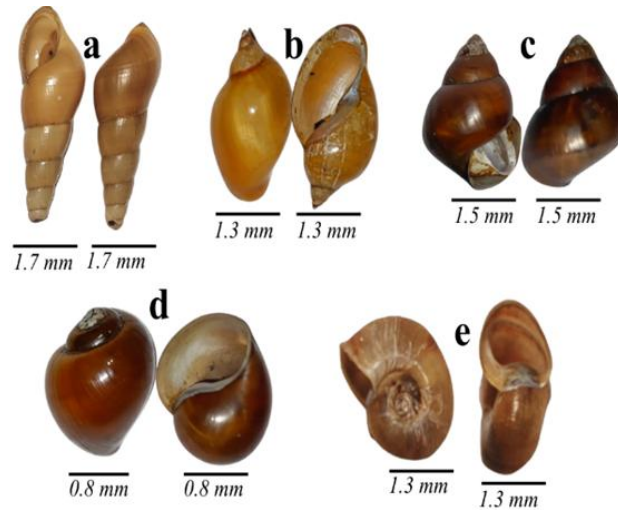
According to the method described by (Seng Chiew Toh, Samuel Lihan, 2023), healthy leaves were selected, washed, shade-dried, and subsequently ground into powder. The infusion was prepared using the hot-water extraction method (approximately 90 °C for 15 min) with distilled water as the solvent to obtain concentrations of 0.5%, 1%, and 2%, with minor modifications in working volume to meet laboratory assay requirements. Commercial praziquantel tablets (pharmaceutical manufacturer, Indonesia) dissolved in 0.5% DMSO were used as the positive control. Snails were collected using hand nets, and sampling locations were recorded using a GPS device (Garmin®, USA). Snails were morphologically identified using a stereo microscope (Olympus®, Japan). Cercariae were obtained using the snail-crushing method and identified under a light microscope (Olympus®, Japan). Each experimental group consisted of five cercariae exposed to the respective treatment solutions, and cercarial movement and viability were observed at the designated time intervals. The primary parameter measured was cercarial mortality, defined as the absence of body movement and lack of response to mechanical stimulation. Data were presented as counts and percentages of cercarial mortality. Statistical analyses were performed using SPSS software, with normality assessed by the *Shapiro–Wilk test* and *homogeneity* evaluated using *Levene’s test*. As the data were not normally distributed, differences among groups were analyzed using the *Kruskal–Wallis test*, followed by *Mann–Whitney U tests* for pairwise comparisons, with a significance level set at $p < 0.05$ (Adiputra et al., 2021). The research received ethical approval from the Health Research Ethics Committee (KEPK) of the Faculty of Medicine Universitas Palangka Raya under approval number 136/UN24.9/LL/2025.

3. Results and Discussions

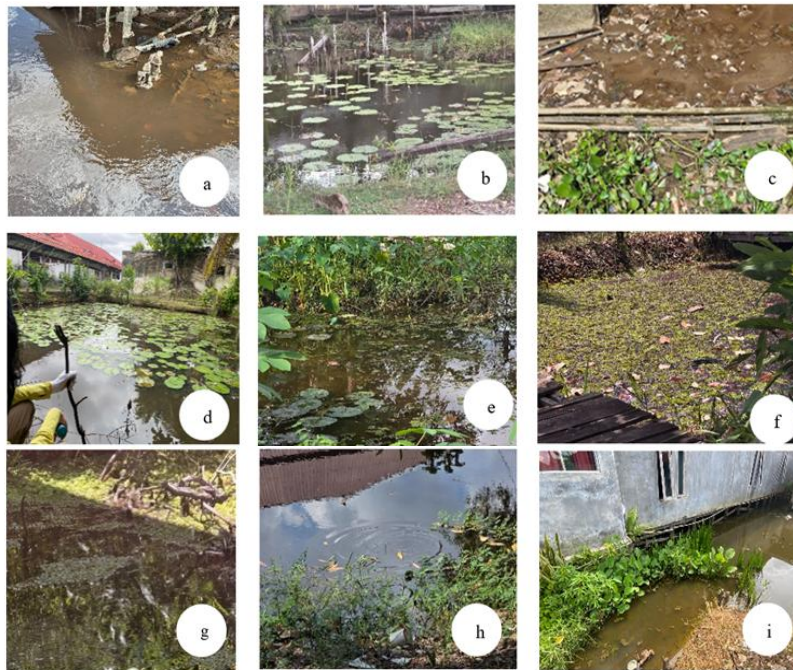
The snail sampling area was located in Selat District, Kapuas Regency, Central Kalimantan Province. Geographically, Selat District is located at coordinates of approximately 3°27'00" South Latitude and 114°44'00" East Longitude, with an area of approximately 111.74 km².²⁹ Based on the latest

administrative data, the population of Selat District is recorded at 71,979.44. Freshwater snails were collected from Selat Subdistrict, Kapuas Regency, Central Kalimantan, an area dominated by riverine and swamp ecosystems that provide suitable habitats for trematode intermediate hosts. Five snail species were identified, namely *Melanoides* sp., *Pila* sp., *Bellamya* sp., *Pomacea* sp., and *Indoplanorbis* sp. These habitats

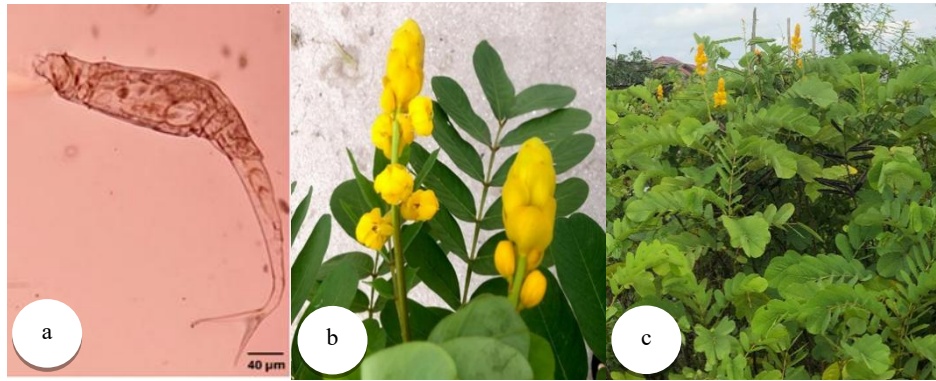
were characterized by slow-flowing or stagnant water with dominant aquatic vegetation such as *eichhornia crassipes*, *pistia stratiotes*, and *nymphaea* sp., which serve as shelter and food sources for snails.



Figures 1. a) *Melanoides* sp., b) *Pila* sp., c) *Bellamya* sp., d) *Pomacea* sp., e) *Indoplanorbis* sp. 5 types of snails obtained in the study of the potential of chinese ketepeng (*Senna alata* (L.) Roxb.) on cercarium mortality



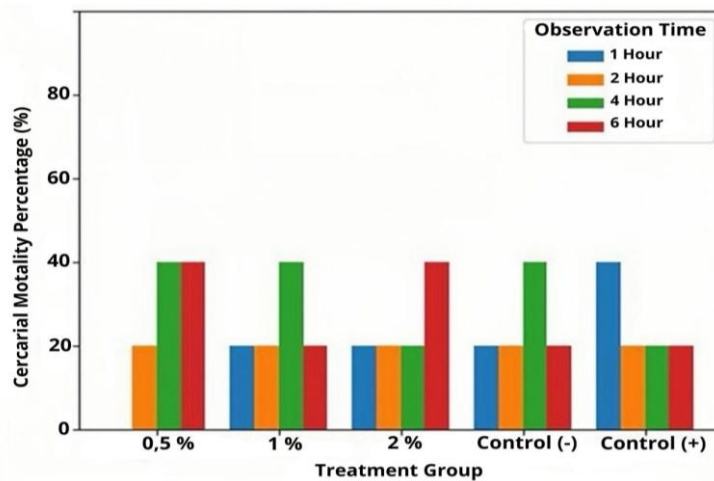
Figures 2. The snail habitats in Selat District, Kapuas Regency, were characterized as follows: in residential yards (f), (g), Kayu Apu plants were observed; in other residential yards (b), (d), (e), (i), Lotus and Genjer plants were present; and in the KP3 Park (c), Water Hyacinth (*Eichhornia crassipes*) was found.



Figures 3. (a) *Furcocercous cercariae* obtained in the study of the potential of chinese ketepeng (*Senna alata* L.Roxb.) on cercaria mortality. (b,c) Plant Ketepeng Cina (*Senna alata* L. Roxb.) obtained in the study of the potential of Chinese ketepeng (*Senna alata* L.Roxb.) on crecarium mortality.

Table 1. Observation results of cercaria mortality after administration of Chinese ketepeng leaf infusion (*Senna alata* L. Roxb.)

	Group Solution	Number of Cercaria	Observation Time			
			1 hour	2 hour	4 hour	6 hour
Cercariae	0,5%	5	0	1	2	2
	1%	5	1	1	2	1
	2%	5	1	1	1	2
	Without being treated	5	1	1	2	1
	Paraziquantel	5	2	1	1	1



Figures 4. Percentage of larval mortality results of the test of the effectiveness of infusion of chinese ketepeng leaf infusion (*Senna alata* L. Roxb.) against cercaria larvae

The dominant plants around the location where the five snail species were discovered are water hyacinth, genjer, apu wood and lotus, which function as shelter and a food source for the snails. In this study, one type of cercariae, *Furcocercous cercariae*, was found to have a morphological characteristic of a tail longer than the body and a forked tail. This cercaria has a prominent sucking structure, in line with the study conducted by Faltýnková *et al.* The cercaria was found to have a long, flat, and oval body. The tail of this cercaria is longer than the body and has a forked tail (furca). The oral sucker is located in the front and the ventral sucker (acetabulum) is located more behind.

Shows that the group with the highest dosen showed excellent effectiveness in terms of larval mortality. The 2% dose treatment showed a mortality

rate of 20% in the first hour and increased to 40% in the sixth hour, indicating an increase in mortality at the end of the observation period. These results indicate that most larvae were unable to survive at this concentration, so it can be said that increasing the dose is directly proportional to increasing larval mortality. This cercariae test study used 25 cercariae divided into five treatment groups, namely Chinese ketepeng leaf infusion at concentrations of 0.5%, 1%, and 2%, as well as negative and positive controls. The results showed that Chinese ketepeng leaf infusion was able to increase cercariae mortality which was influenced by concentration and exposure time, with a concentration of 2% showing the highest percentage of mortality compared to concentrations of 0.5% and 1%, especially in the 4th to 6th hour of observation. The Mann-

Whitney test showed that most comparisons between groups were not significantly different ($p > 0.05$), but there was a significant difference between the 2% concentration and the 0.5% and 1% concentrations ($p = 0.046$), which confirmed that the 2% concentration was the most effective treatment. Morphologically, cercariae exposed to 2% concentration infusion showed decreased swimming activity, paralysis, and damage to the body and tail which were thought to be related to the content of secondary metabolites of *Senna alata* leaves such as anthraquinones, tannins, flavonoids, and saponins, although the limited number of samples and the absence of repetition could affect the overall statistical significance.

4. Conclusion

Senna alata (L.) Roxb. leaf infusion showed potential in increasing cercarial mortality, with the 2% concentration being the most effective compared to 0.5% and 1%. The effectiveness of the infusion was influenced by concentration and exposure time, as indicated by increased mortality and morphological alterations in cercariae. Although not all differences were statistically significant, these findings suggest that *S. alata* leaf infusion has promise as a biological agent for cercarial control. Further studies with larger sample sizes, repeated trials, and field-based conditions are recommended to strengthen and validate these results.

Conflict of interest statement

The authors declare that there is no conflict of interest.

Acknowledgements

Appreciation goes to the Head of Selat District for the permission and support that enabled me to conduct this research in the area.

Authors' contributions

GMK, PC performed conceptualization, methodology, writing, review and editing. VS, NT performed investigation, supervision, visualization. A and DF performed revision, editing, analyzed and writing.

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