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In vivo assay of *Gigantochloa apus* shoot extract as biolarvicide for myiasis-causing fly larvae

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ABSTRACT

The use of synthetic insecticides in treating myiasis is associated with adverse side effects and potential disruption of metabolic systems, prompting interest in natural alternatives. This study investigated the *in vivo* larvicidal efficacy of *Gigantochloa apus* bamboo shoot extract, formulated as a spray gel. Twenty-five Wistar rats were randomly divided into 5 groups: a negative control group, a positive control (ivermectin), and 3 treatment groups receiving of 1%, 3%, and 5% *G. apus* bamboo shoot extract. Myiasis was induced by introducing fly larvae into standardized wounds. Treatments were applied topically twice daily for 32 hr, and larval mortality was assessed every 8 hr. Phytochemical screening and GC-MS analysis revealed the presence of bioactive compounds, including alkaloids, flavonoids, tannins, saponins, and hydrogen cyanide, all of which are known for their larvicidal, neurotoxic, and antiproliferative properties. The 5% extract group showed the highest mortality rate (100%) at 32 hr. The LC_{50} and LC_{95} values were determined at 1.43% and 6.01%, respectively. Compared to the standard ivermectin treatment, the 5% extract demonstrated a shorter lethal time and more rapid larval death. Morphological examination revealed darker abdominal segments in the dead larvae, indicating a potential interaction with the digestive tract. These findings indicate that *G. apus* bamboo shoot extract has potential larvicidal activity and can be an effective natural alternative for treating myiasis.

Keywords:
Gigantochloa apus (bamboo) shoot extract;
fly larvae;
mortality;
myiasis

ABSTRAK

Penggunaan insektisida sintetis dalam pengobatan myiasis menunjukkan efek samping yang merugikan dan potensi gangguan sistem metabolisme, sehingga mendorong minat terhadap penggunaan alternatif bahan alami. Penelitian ini menyelidiki efektivitas larvasida secara *in vivo* dari ekstrak rebung *Gigantochloa apus* yang diformulasikan dalam bentuk gel semprot. Dua puluh lima tikus Wistar secara acak dibagi menjadi lima kelompok, yaitu kelompok kontrol negatif, kontrol positif (ivermectin), dan tiga kelompok perlakuan yang masing-masing dengan penambahan ekstrak rebung *G. apus* 1%, 3%, dan 5%. Myiasis diinduksi dengan menginfestasi luka standar dengan larva lalat. Perlakuan diberikan secara topikal dua kali sehari selama 32 jam, dan mortalitas larva dinilai setiap 8 jam. Skrining fitokimia dan analisis GC-MS mengungkapkan keberadaan senyawa bioaktif termasuk alkaloid, flavonoid, tanin, saponin, dan hidrogen sianida, yang semuanya dikenal karena sifat larvasida, neurotoksik, dan antiproliferatifnya. Hasil tingkat mortalitas tertinggi (100%) ditunjukkan oleh kelompok ekstrak 5% pada 32 jam. Nilai LC_{50} dan LC_{95} masing-masing ditetapkan sebesar 1,43% dan 6,01%. Dibandingkan dengan perlakuan kontrol ivermectin, ekstrak 5% menunjukkan waktu kematian larva yang lebih singkat dan lebih cepat. Pemeriksaan morfologi menunjukkan segmen abdomen yang lebih gelap pada larva yang mati, hal ini menunjukkan potensi interaksi dengan saluran cerna. Temuan ini menunjukkan bahwa ekstrak rebung *G. apus* memiliki aktivitas biolarvisida yang berpotensi dan dapat menjadi alternatif alami yang efektif untuk mengatasi myiasis.

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INTRODUCTION

Low socioeconomic conditions are associated with an increased risk of parasitic infections such as myiasis, a condition transmitted to humans and animals through contact with flies, particularly when open wounds are present.[1,2] Myiasis is the infestation of body tissues by fly larvae (Diptera), which can affect both dead and living tissues, organs, and bodily fluids. In humans, the larvae may feed on tissue or intestinal contents.[2] Myiasis is a zoonotic disease, meaning it can infect a wide range of warm-blooded vertebrates, including humans.[3] Typically, the infestation begins at sites of injury or open skin, where the larvae penetrate and burrow into the underlying muscle tissue, forming tunnels. This process leads to swelling and tissue damage, making myiasis a significant public health concern due to its potential to cause severe infections and complications.[4]

Aggressive surgical debridement can be used to treat myiasis and prevent serious tissue damage.[5] In addition, topical agents, antibiotic therapy, and synthetic insecticides can also be administered.[6] Synthetic insecticides, such as ivermectin, coumaphos, diazinon, and fenthion, are often used to manage myasis.[7] However, the use of synthetic insecticides can have side effects, such as toxicity in humans and livestock, carcinogenicity, and the development of resistant strains.[8] Moreover, insecticides use can disrupt metabolic processes and increase the risk of cross-resistance to other parasitic agents.[8]

Natural products are increasingly popular for use in the health sector because they tend to cause fewer adverse effects and are generally more affordable. Bamboo apus or *Gigantochloa apus* (bamboo) is a type of bamboo from the family *Poaceae* that many Indonesian people find and use as furniture or building materials.[9] However, its shoots are less frequently consumed due to their bitter taste, attributed to cyanogenic compounds such as hydrogen cyanide and palmitic acid.[10] The cyanide content and palmitic acid in *G. apus* shoots are reportedly quite lethal to fly larvae but are not significantly toxic to humans.[11] The hydrogen cyanide concentration in *G. apus* shoots is less than 10 ppm, which is low and safe in accordance with the toxicity limits for human skin and the body.[12] In addition, *G. apus* shoots contain antioxidant compounds that may contribute to anti-inflammatory effects.[13]

The natural potential of bamboo shoots presents a promising opportunity for their development as spray-based bioinsecticides targeting fly larvae that cause myiasis. To evaluate the effectiveness of a biolarvicide derived from *G. apus* shoot extract, experimental procedures including *in vivo* assays in rats, are required. Currently, there are no published studies investigating the use of *G. apus* shoot extract as a treatment for myiasis. Therefore, this study is the first to explore its potential larvicidal activity against myiasis-causing fly larvae. Ultimately, this research aims to contribute to the development of an effective and natural alternative for controlling myiasis through bamboo shoot-based larvicidal formulations.

MATERIAL AND METHODS

Extraction of *G. apus* shoots

Gigantochloa apus shoots were collected from Ngandong, Yogyakarta, Indonesia. The dried *G. apus* shoots were ground into simplicial powder. The extraction process was carried out using the maceration method with methanol as the solvent at a ratio of extract to methanol of 1:10 at room temperature for 72 hr. The extract obtained was filtered through Whatman No.1 filter paper and evaporated via a rotary evaporator

(Heidolph Rotary Evaporator Hei-VAP) at 40°C and 50 rpm. The extract was stored in a refrigerator until further use. All extraction procedures were conducted at the Pharmaceutical Technology Laboratory, Faculty of Medicine, Universitas Diponegoro, Semarang.

Phytochemical analysis

Phytochemical screening using the tube method and thin layer chromatography (TLC) was carried out as qualitative preliminary tests. Gas chromatography–mass spectrometry (GC–MS) of a bamboo shoot extract smear was performed using a GCMS instrument (Shimadzu GCMS-QP 2010 Ultra) with a FAMEWAX (polyethylene glycol) stationary phase with a column length of 30 m and a diameter of 0.25 mm. The components obtained were identified based on the NIST Database 11. The analysis was conducted at the Integrated Laboratory of Bioproduct (ILab), National Research and Innovation Agency (BRIN).

Quantitative analysis was performed on compounds that tested positive during qualitative screening, using compound-spesific methods. In addition, hydrogen cyanide levels were measured using the argentometric method, following the protocol described by Soesanto.[10] Hydrogen cyanide concentrations were calculated using the following formula:

$$Hydrogen\ cyanide\ = \frac{ml\ titration\ (blank - ex,)}{ml\ blank\ titration} 20\ \frac{N.AgNO3}{Aquades\ Volume\ (l)}\ 0.54\ mg$$

After the results of the compound content are known, the levels in each given experimental formulation are determined via the following formula:

$$N = \frac{Compound\ Concentration\ \ x\ Variation\ Weight\ (gr.)}{Test\ Sample\ Volume\ (gr.)}$$

Formulation of spray gel preparation

The manufacturing process began with weighing all required ingredients, followed by grinding 0.1% hydroxyethyl cellulose (HEC) and 0.1% hydroxypropyl methylcellulose (HPMC), which functioned as gelling agents. A solution containing 0.18% methylparaben, *G. apus* extract, and 15% propylene glycol was prepared using a magnetic stirrer at 1,200 rpm for 10 min. This solution was then combined with the HEC and HPMC mixture and maintained at 30°C under continuous stirring until a thick, homogeneous gel mass was formed.

The resulting formulations underwent physical characterization, including organoleptic evaluation (color, odor, and dosage form), viscosity measurement using a Brookfield DV1 viscometer, homogeneity testing, and pH measurement (Mettler Toledo, SevenCompact S220). These tests were conducted over a 28-d period, beginning on day 0.

***In vivo* assay-larvicide effectiveness**

This study was carried out via the true experimental design with a posttest-only control group, employing rats as experimental subjects. The study was conducted at the Experimental Animal Laboratory, Faculty of Medicine, Universitas Diponegoro, Semarang. A randomization procedure was applied to assign animals to groups in order to minimize bias related to age, body weight, and other factors. Each group consisted of 5 rats, and there were 5 treatment groups in this total; thus, 25 rats were used in this study. The animals were 2-3 mo, weighed 180–200 g, and underwent a 7-d acclimatization period prior to experiment. During acclimatization, they were provided with food and water ad libitum in individual cages.

TABLE 1. Research treatment groups

Group	Treatment
NC (-)	-
PC (+)	Ivermectin spray
P1	*G. apus* shoot extract 1%
P2	*G. apus* shoot extract 3%
P3	*G. apus* shoot extract 5%

Note: PC (+): positive control; NC (-): negative control; P: treatment group

The testing procedure began by establishing a colony of fly larvae, followed by the infestation of Wistar rats with larvae to induce myiasis. The dorsal fur of each rat was shaved, and a standardized square-shaped wound was created using a sterile scalpel, with a depth of approximately 2 mm and a length of 2 cm. First-instar larvae (L1) were applied to the wounds using sterile tweezers, with 10 larvae allocated to each rat in the respective treatment groups. To facilitate larval infestation, rats were anesthetized using a combination of ketamine, xylazine, and aquabidest in a 1:1:1 ratio, administered at a dosage of 0.3 mL/25 g BW. The wounds were then covered with moist gauze to simulate conditions favorable for myiasis development, allowing the larvae to penetrate the skin and form typical myiasis lesions. After infestation, each rat was housed individually for 2 d.

After 2 d, the gauze was removed, and the rats were grouped accordingly, as shown in TABLE 1. The number of larvae contained in the wound was counted, and the diameter of the wound was measured. Next, each group was treated by spraying *G. apus* shoot extract twice daily, at 6:00 AM and 6:00 PM. The primary variable observed in this study was larval mortality, which was recorded every 8 hr. Larvae were considered dead if no movement of the anterior and posterior segments was observed when stimulated with a blunt needle. The number of dead and remaining larvae in each experimental group was recorded. The study was approved by the Ethics Committee, Faculty of Medicine, Universitas Diponegoro, Semarang (Approval No. 31/EC/H/FK-UNDIP/I/2022).

To analyze the toxicity effects, a probit analysis was carried out to determine the larvicidal ability of the bamboo shoot extract on the mortality of fly larvae. Probit analysis was carried out by analyzing the lethal concentrations (LC_{50} and LC_{95}) and lethal times (LT_{50} and LT_{95}). Larval mortality data were corrected using Abbot's formula to obtain a mortality percentage.

RESULTS

Characteristics of the extracted compounds

Phytochemical screening was conducted as a qualitative test to identify the presence of alkaloids, flavonoids, saponins, triterpenoids, steroids, and tannins in the *G. apus* shoot extract. The result of phytochemical screening is presented in TABLE 2.

The results revealed that the *G. apus* shoot extract contained alkaloids, saponins, flavonoids, and tannins. This finding is reinforced by previous research by Setiawan *et al.*[15] which revealed that *G. apus* contains alkaloids, flavonoids, tannins and saponins. The results of TLC are shown in FIGURES 1-3.

Phytochemical compounds from *G. apus* shoot extract were identified via GC–MS. *Gigantochloa apus* shoot extract is dominated by toxic compounds, as presented in TABLE 3 and 4.

TABLE 2. Phytochemical screening of *G. apus* shoot extract

Compound		Results
Alkaloid	+	Brown precipitate
Flavonoid	+	A yellow color form
Saponin	+	Forms stable foam
Steroid	-	No greenish ring
Tannin	+	Forms a dark green

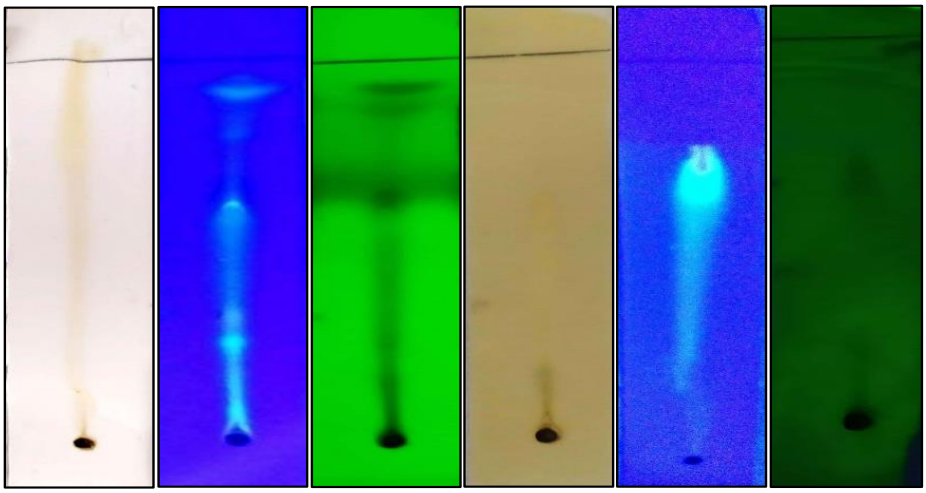

FIGURE 1. TLC identification results for alkaloid. (A) Visual observation under visible light before reagent application; (B) observation under 366 nm UV light before reagent application; (C) observation under 254 nm UV light before reagent application; (D) visual observation under visible light after spraying with dragendorff reagent; (E) observation under 366 nm UV light after dragendorff spraying; (F) observation under 254 nm UV light after dragendorff spraying.

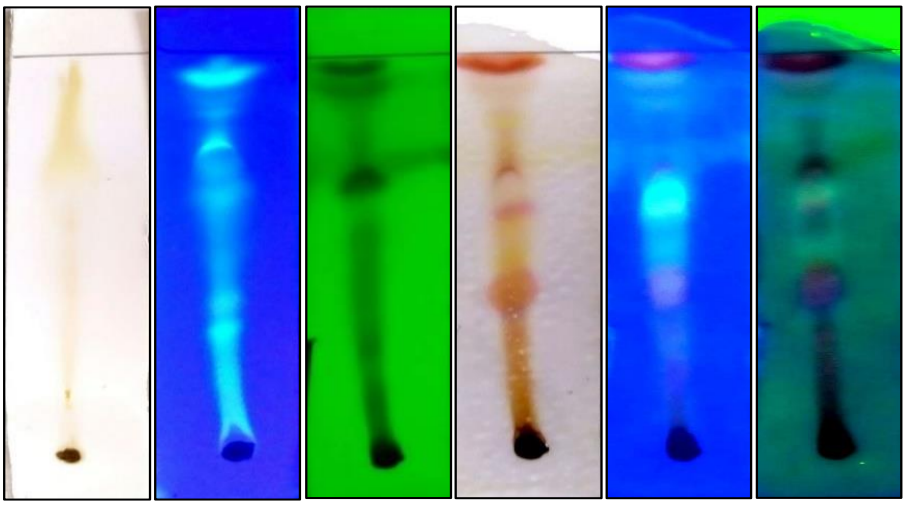

FIGURE 2. TLC identification results for phenolic. (A) Visual observation under visible light before reagent application; (B) observation under 366 nm UV light before reagent application; (C) observation under 254 nm UV light before reagent application; (D) visual observation under visible light after spraying with sulfuric acid, (E) observation under 366 nm UV light after sulfuric acid spraying, and (F) observation under 254 nm UV light after sulfuric acid spraying.

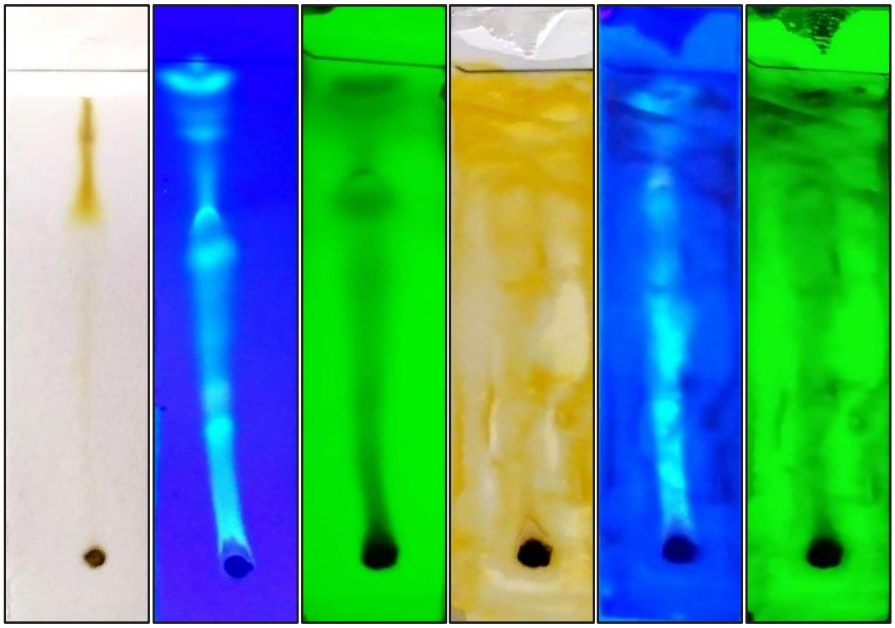

FIGURE 3. TLC identification results for of tannin. (A) Visual observation under visible light before reagent application; (B) observation under 366 nm UV light before reagent application; (C) observation under 254 nm UV light before reagent application; (D) visual observation under visible light after spraying with $FeCl_3$, (E) observation of 366 nm UV light after $FeCl_3$ spraying, and (F) observations of 254 nm UV light after $FeCl_3$ spraying.

TABLE 3. Compound profile identified by GC–MS analysis of *G. apus* (bamboo) shoot extract.

Area (%)	Compound	Activity
4.57	Benzenemethanol, 3-hydroxy-	Phenolics[16]
14.78	Benzaldehyde, 4-hydroxy-	Antioxidants[16]
3.67	Benzeneacetonitrile, 4-hydroxy-	Phenolics[16]
7.77	1,2,3,5-Cyclohexanetetrol, (1.α, 2.β, 3.α, 5.β).	-
15.53	Tetratriacontane	-
3.38	Bis (2-ethylhexyl) phthalate	Antimicrobial[17]
23.69	n-Hexadecanoic acid	Antibacterial, antiparasitic[18]
5.56	Triacontane	-
17.61	cis-9-Hexadecenal	Antifungal, anti-melanogenic[19]
3.44	Octadecanoic acid, 2-(2-hydroxyethoxy) ethyl ester	Antioxidant, antibacterial[16]

Mortality percentage of fly larvae and larvicide effectiveness

FIGURE 4 illustrates that the addition of *G. apus* shoot extract in the treatment groups had a significant effect on the mortality of larvae infesting the experimental animals. The results of the normality test via the Shapiro–Wilk test revealed that in the P1, P2, P3 and PC (+) groups, the distribution was normal ($p > 0.05$), whereas in the NC (–) group, the distribution was not normal. Therefore, the subsequent difference test was carried out using the Kruskal–Wallis test, followed by the Mann–Whitney test, based on larval mortality data at 32 hr.

The test results revealed that there was a difference in the average mortality of larvae according to the Kruskal–Wallis test, with a p value of <0.001. To determine the differences between treatment groups, the Mann–Whitney test was used. Mortality in groups P1, P2, and P3 was first observed at the 8th hour of the observation period, with the P3 group showing the highest mortality rate. This increased mortality is likely due to the addition of *G. apus* shoot extract in the formulation, which appears to act effectively as a digestive larvicide. This effect was observed when the larvae were still in the first instar (L1) stage, particularly between the 8th and 24th hr of observation. The presence of active compounds in the extract is believed to exert a stomach poison mechanism, as evidenced by the darkened or blackened abdominal segments in dead larvae, as shown in FIGURE 6B. Overall, larvae in all treatment groups that received the extract displayed darker abdominal morphology, suggesting the extract's digestive mode of larvicidal action.

The LT_{50} and LT_{95} values represent the times required to cause 50% and 95% larval mortality, respectively. A smaller lethal time indicates greater effectiveness of the formulation as a larvicide. The LC value is the concentration required to cause mortality in the larvae that cause myiasis. The results of the LT values are presented in FIGURE 7.

TABLE 4. Quantitative analysis of hydrogen cyanide, tannin, and phenol contents in each formulation of *G. apus* shoot extract

Formulation code	Hydrogen cyanide (ppm)	Tannin (%)	Phenol (%)
P1	0.068	0.075	0.171
P2	2.030	0.225	0.513
P3	3.384	0.375	0.855

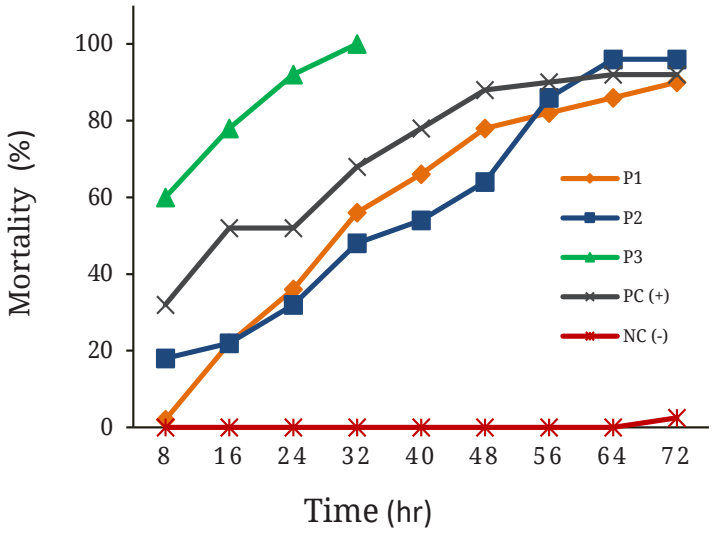

FIGURE 4. Larval mortality (%)

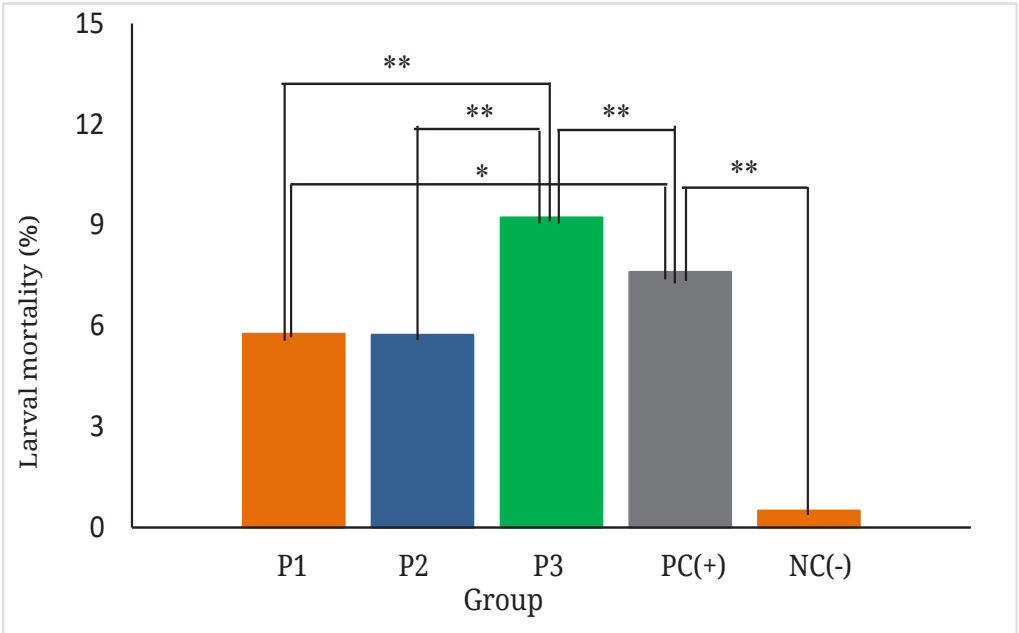

FIGURE 5. Average of fly larval mortality (%) at 32 hr, along with comparisons between treatment groups. The data is presented as means ± standard deviations (SD) from independent experimental replicates. *p<0.05, **p<0.01.

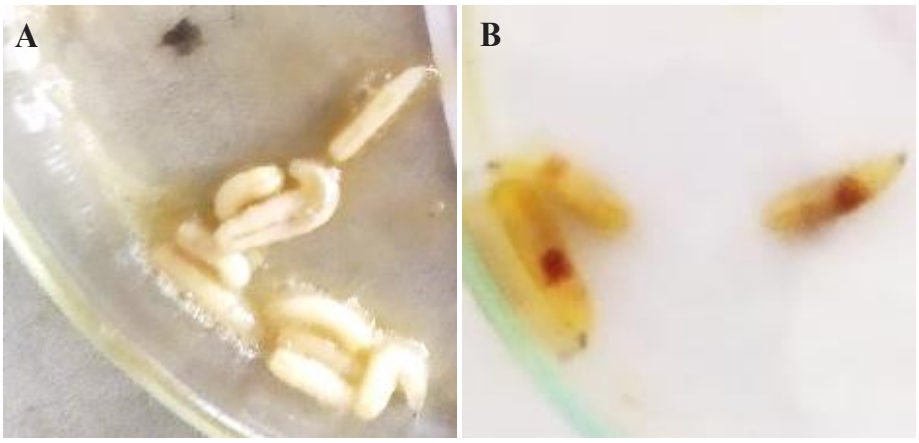

FIGURE 6. Samples of myiasis-causing fly larvae used in this study. (A) Fly larvae prior to infestation; (B) Fly larvae after exposure to *G. apus* shoot extract.

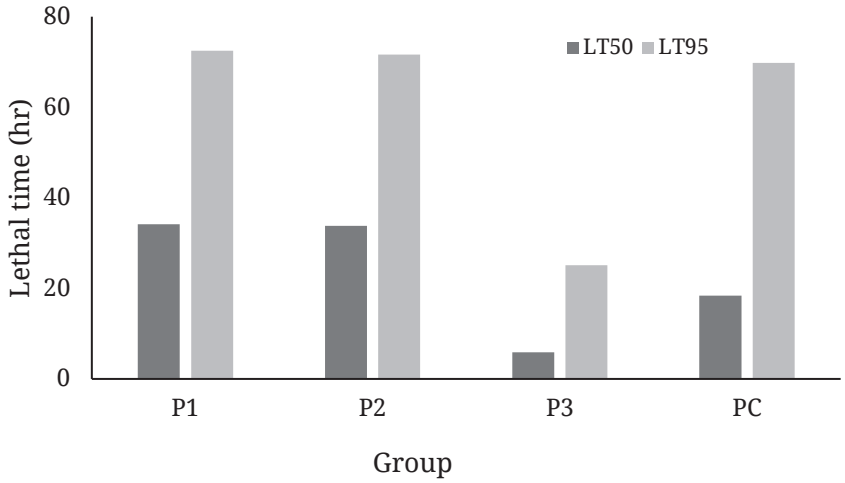

FIGURE 7. Analysis of the lethal time for each treatment

DISCUSSION

Gigantochloa apus (bamboo) shoots belong to the Poaceae family, which is known to possess several biological activities, including cytotoxic, hemolytic, anti-inflammatory, antifungal, antiparasitic, and antibacterial properties.[20,21] Benzenemethanol, 3-hydroxy, benzaldehyde, 4-hydroxy, benzeneacetonitrile, and 4-hydroxy are phenolic compounds identified in the extract.[22] The most abundant component found in *G. apus* shoot extract is n-hexadecanoic acid. Chemicals are included in the group of fatty acids that function in antibacterial, antifungal and antiparasitic activities.[23] Other compounds, such as bis (2-ethylhexyl) phthalate, cis-9-hexadecenal, octadecanoic acid, and 2-(2-hydroxyethoxy) ethyl ester, were identified as cytotoxic antioxidants.[19]

Phytochemical and TLC analysis

confirmed the presence of alkaloids in the extract. Alkaloids are compounds that contain nitrogen as part of their cyclic system and contain various substituents, such as phenol and methoxy amine groups, such that alkaloids are semipolar.[24] The alkaloid compounds contained in the bamboo shoot extract are strengthened on the basis that *G. apus* shoots are a type of bamboo shoot that is rarely consumed because they have a more bitter taste than other types of bamboo shoots. In addition, *G. apus* shoots are known to have a fairly high hydrogen cyanide content compared with other types of bamboo shoots, namely, 15.33 mg/L.[10] The hydrogen cyanide contained in *G. apus* was relatively low, making it safe and non-toxic. The results of the compound analysis in TABLE 4 show that the hydrogen cyanide level is not more than 10 ppm. The hydrogen cyanide level that is safe for human skin and the body is <10 ppm.[12]

The results of TLC identification of the flavonoid compounds (FIGURE 2) revealed positive reaction, as indicated by the presence of yellow and red spots after spraying with sulfuric acid reagent (H_2SO_4) and bright blue fluorescence under 366 nm UV light. Alkaloids, flavonoids, and tannins were all confirmed, and these compounds are recognized for their larvicidal potential.

Gradually, the larvae exhibited sluggish movements and become flaccid, which was presumed to result from the biolarvacide treatment with *G. apus* shoot extract. Data were collected at 8, 16, 24, 32, 40, 48, 56, 64, and 72 hr. However, the mortality results for each treatment differed in mortality time. This is thought to be due to the influence of the amount of extract added in the different treatments. A graphic representation of the percentage mortality of the fly larvae that cause myiasis in experimental animals every hour is shown in FIGURE 4.

On the basis of the results of in vivo larval death, the bamboo shoot extract is thought to function as a gastric poison, as indicated by the blackish appearance of the larva's stomach. The darker color around the stomach means that the absorption of the bamboo shoot extract mostly occurs in the middle digestive tract or mesenteron, which is composed of epithelial cells.[6] *Gigantochloa apus* shoot extract probably works as a poison that affects the epithelial cells in the digestive tract of the larvae so that the dead larvae have darker or blackish middle-body conditions. This is confirmed by the presence of the hydrogen cyanide compound in *G. apus* shoot extract, which is very quickly absorbed by the digestive tract and enters the bloodstream, so it can cause death depending on the level; the higher the level is, the greater the degree to which it has a lethal effect.[10] The most effective treatment was the addition of 5% bamboo shoot extract, which has a high level of hydrogen cyanide, namely 3.384 ppm, and resulted in more larval death compared with other treatments.

The extract tested positive for alkaloids, flavonoids, tannins, and saponins. According to Laksono *et al*.[26] alkaloid compounds can have larvicidal effects by disrupting the nervous system of larvae by inhibiting the action of acetylcholinesterase (AChE).[26] Changes in larval body coloration and slowed movements are characteristics effects associated with alkaloid exposure.[27] *Gigantochloa apus* shoots have also been shown to contain saponin compounds that can influence the activity of digestive enzymes and reduce food absorption in larvae.[26]

Among all groups, the P3 formulation (5% extract) demonstrated the highest larvicidal activity. This correlates with the higher concentration of active compounds, particularly tannins (0.375%). Tannins in *G. apus* shoots can have both direct and indirect effects on fly larvae. This is reinforced by previous

research regarding the effects of *G. apus* on *Haemonchus contortus*.[11] Previous studies have shown that the mechanism of action of tannins occurs directly when they penetrate the larval cuticle and cause structural damage, as well as disrupt the protein nutrition of the skin.

Probit analysis revealed LC_{50} and LC_{95} values of 1.43% and 6.006%, respectively. The 5% extract was close to the LC_{95} value, indicating high larvicidal potency. Compared to the positive control group treated with ivermectin, the 5% extract group had shorter lethal times (LT_{50} and LT_{95}), suggesting more rapid efficacy. Thus, P3 with an added concentration of bamboo shoot extract of 5% has the potential to be effective in killing fly larvae infested in Wistar rats. This finding is related to the relatively high concentrations of the compounds present.

The positive control group, in which ivermectin was administered to the experimental animals, demonstrated a lethal time (LT_{50}) of 18.38 hours and an LT_{95} of 69.79 hours. As shown in FIGURE 8, the LT values for the P3 treatment group were lower than those observed for ivermectin, indicating a faster larvicidal effect. Based on these findings, it is suggested that ivermectin primarily acts as a contact poison, with absorption through the larval cuticle playing a key role in its mechanism of action. This hypothesis is supported by previous studies reporting ivermectin's efficacy in treating myiasis through both oral administration and topical irrigation, thereby emphasizing its effectiveness via transcuticular absorption.

Flavonoids have larvicidal effects due to their ability to disrupt epigenetic pathways.[28] These pathways may be associated with DNA fragmentation in larval cells, ultimately leading to apoptosis. In addition, Zanoaga *et al.* revealed that flavonoid compounds and their derivatives play an important role in disrupting protein activity regulation. This effect is related to the inhibition of protein kinase activation at the ATP-binding site, thereby suppresing cell growth.[29] Flavonoid compounds have been proven to have significant antiproliferative effects. The mechanism of action of this compound as an antiproliferative agent involves the inhibition of signals to the cell nucleus.[30]

Overall, the test results revealed that the greater the extent of larval mortality in *G. apus* shoots, the more effective the larval mortality. This is supported by the fact that at the highest concentration, namely 5%, P3 contained a higher level of active compared with the other formulations. Ivermectin has been widely reported to have effects on environmental pollution and resistance because it contains chemicals that are difficult to decompose in nature.[31] Moreover, insecticides from natural resources are considered safer to use because they are easily decomposed in nature, do not have a polluting effect on the environment and are relatively safe for humans. Currently, traditional herbal medicines are being increasingly developed as potential treatment for myiasis.

This study investigated the effectiveness of *G. apus* shoot extract against myiasis infection through an in vivo assay. The research is particularly valuable as no similar studies have been reported, highlighting its potential contribution to the development of natural therapeutic agents derived from Indonesian biodiversity. However, a notable limitation of this study was the lack of definitive identification of the larval species used in the experiment. Future research is encouraged to expand on these findings through clinical trials involving larger experimental animals such as goats, cattle, or buffaloes. Additionally, controlled clinical studies in human subjects with myiasis could provide further insight into the therapeutic potential and safety profile

of *G. apus* shoot extract.

CONCLUSION

Gigantochloa apus (bamboo) shoot extract contains active compounds such as alkaloids, flavonoids, tannins, and saponins. At a 5% concentration, the extract significantly increased fly larval mortality, with LT_{50} at 5.9 hr, LT_{95} at 25.13 hr, and LT_{100} at 32 hr. These findings suggest that *G. apus* bamboo shoot extract has potential as an effective biolarvicide for the treatment of myiasis caused by fly larvae in Wistar rats.

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