

Plant-based bioinsecticide from *Jatropha gossypiifolia* and cattle urine for horsefly control

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ABSTRACT: Bioinsecticides are natural compounds with toxic properties that can inhibit the growth and development of pests that affect crops and livestock. This study aimed to evaluate the effectiveness of a bioinsecticide formulation derived from red jatropha (*Jatropha gossypiifolia*) leaf extract combined with cattle urine against ectoparasites in cattle. The experiment was a completely randomized design (CRD) involving 200 flies, which were divided into four treatment groups with concentrations of 0%, 10%, 15%, and 20%, each replicated three times. The results demonstrated that the bioinsecticide formulation at a concentration of 20% had a significant effect on fly mortality compared to lower concentrations. These findings suggest that the combined use of 20% red jatropha leaf extract and cattle urine is a promising and environmentally friendly alternative for controlling fly populations in cattle.

Keywords:

Jatropha gossypiifolia, cow urine, bioinsecticide, ectoparasites

■ INTRODUCTION

Bioinsecticides derived from natural materials have toxic effects that can disrupt pest growth, development, reproduction, and behavior while also acting as repellents, attractants, or feeding inhibitors (Binawati & Amilah 2013). Plants containing secondary metabolites, such as flavonoids, tannins, saponins, terpenoids, and alkaloids, are widely recognized as potential agents for bioinsecticide development (Handayani *et al.* 2018).

Red jatropha (*Jatropha gossypiifolia* L.), native to South America and now widely distributed in tropical regions, contains bioactive compounds including alkaloids, flavonoids, saponins, tannins, and steroids. These compounds have been associated with antioxidant, anti-inflammatory, anticancer, and antibacterial properties (Ahriani *et al.* 2021). Despite this potential, red jatropha remains underutilized and is often regarded merely as a roadside shrub.

In cattle farming, urine is an abundant by-product that is often discarded and underutilized compared to feces, and is widely used as an organic fertilizer (Ilhamiyah *et al.* 2021). Although cattle urine can be processed into liquid organic fertilizer, its use is limited because of its lower nutrient content than that of solid fertilizers (Huda 2013). However, with high carbon and nitrogen content, cattle urine has the potential for bioinsecticide development (Pujiastuti *et al.* 2021). Given the persistent fly infestation problem in cattle farms, integrating cattle urine with red jatropha leaf extract offers a promising alternative for sustainable pest management. This

study aimed to evaluate the effectiveness of a bioinsecticide formulation combining red jatropha leaf extract and cattle urine against ectoparasitic flies.

■ MATERIALS AND METHODS

This study was conducted at the Batu Livestock Training Center, Malang, East Java Indonesia. A total of 200 *Tabanus bovinus* (horseflies), common blood-feeding ectoparasites in cattle, were used as experimental subjects. The flies were collected manually and placed in four plastic containers, each equipped with aeration holes and containing 50 individuals.

The experiment followed a completely randomized design (CRD), with four treatment groups consisting of one control and three treatments. The groups were as follows: P0 (control) = 0% red jatropha leaf extract + 20 mL cattle urine, P1 = 10% red jatropha leaf extract + 20 mL cattle urine, P2 = 15% red jatropha leaf extract + 20 mL cattle urine, and P3 = 20% red jatropha leaf extract + 20 mL cattle urine. Treatments were applied by spraying twice daily at 08:00 and 15:00 local time (WIB).

Data on fly mortality were recorded and analyzed using IBM SPSS Statistics version 25.0 to determine the concentration with the highest mortality rate.

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■ RESULTS AND DISCUSSION

The effects of the treatments on horsefly (*Tabanus bovinus*) mortality are presented in Table 1. The results showed that the mortality rate of *T. bovinus* was 26% with the application of 10 g red jatropha leaf extract, 38% with 15 g extract, and 54% with 20 g extract, all in combination with 20 mL cattle urine. The highest mortality (54 %) was recorded for treatment P3 (20 g extract + 20 mL urine). These findings indicate a dose-dependent response, in which increasing concentrations of red jatropha leaf extract corresponded with higher fly mortality.

The observed mortality did not occur immediately after contact with the bioinsecticide formulation but progressed gradually. Early symptoms in the treated flies included a marked reduction in activity. While untreated flies remained highly active with frequent flight movements, treated flies exhibited reduced flight intensity and settled at the bottom of the experimental containers. Dead flies were observed in the evening. This gradual effect reflects the mode of action of bioactive compounds in red jatropha leaves, such as flavonoids, alkaloids, saponins, and tannins, which can disrupt insect physiology and behavior, ultimately leading to death (Ahyanti & Yushananta 2023).

Flavonoids are known to damage spiracles located on the body surface of insects, thereby disrupting the respiratory system. Once absorbed, flavonoids weaken insect nerve function, causing respiratory failure and eventual death. Alkaloids directly affect insect muscle activity, stimulating excessive oxygen demand and resulting in paralysis and mortality. Saponins act as toxins that penetrate the insect cuticle, impairing internal organ function and contributing to lethality (Yuliana *et al.* 2016).

The synergistic effects of these compounds are supported by previous findings indicating that red jatropha contains active metabolites toxic to insects, capable of disrupting respiratory and neuromuscular function (Tridesianti *et al.* 2025). Furthermore, when combined with cattle urine, which contains ammonia, the formulation intensifies respiratory disruption in flies, thereby enhancing mortality rates. Accordingly, the highest mortality (54%) observed in treatment P3 demonstrated the potential of red jatropha leaf extract, particularly at higher concentrations, in combination with cattle urine, as an effective and environmentally friendly bioinsecticide against *T. bovinus*.

Table 1. Percentage mortality of *Tabanus bovinus* exposed to bioinsecticide formulations

Group	Jatropha leaf extract (g)	Horsefly (<i>Tabanus bovinus</i>)			Mortality (%)
		Death	Live	Total	
P0	0	13	37	50	26
P1	10	19	31	50	38
P2	15	25	25	50	50
P3	20	27	23	50	54

Note: P0 = control (urine), P1 = 10 g jatropha leaf extract and 20 mL urine, P2 = 15 g jatropha leaf extract and 20 mL urine, P3 = 20 g jatropha leaf extract and 20 mL urine.

■ CONCLUSION

The bioinsecticide formulation combining red jatropha (*Jatropha gossypiifolia*) leaf extract and cattle urine proved effective at a concentration of 20% extract with 20 mL urine for controlling horseflies (*Tabanus bovinus*). Bioactivity is attributed to secondary metabolites, such as flavonoids, alkaloids, saponins, and tannins, which act as toxic agents by disrupting the insect respiratory system, ultimately leading to mortality.

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