Diazinon, Tephrosia vogelii, and Cissus quadrangularis for Flea Control in Chickens: A Comparative Study

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Research Article

Keywords: Chicken, Cissus quadrangularis, Diazinon, Experimental study, Tephrosia Vogelii, Burji

Posted Date: May 13th, 2025

DOI: https://doi.org/10.21203/rs.3.rs-6570172/v1

Additional Declarations: No competing interests reported.

Abstract

Commercial insecticides, typically employed for poultry's flea control, nevertheless there is a limitations on use of insecticide in the Ethiopian poultry sector due to high costs and availability. Consequently, ectoparasites pose a substantial health risk to chicken production across Ethiopia. This study aims to evaluate and compare the effectiveness of diazinon, Tephrosia vogelii, and Cissus quadrangularis in eradicating flea infestations in chickens within the Burji, Ethiopia. Furthermore, this research seeks to identify and explore alternative, locally accessible, and economically viable remedies for poultry farmers. A laboratory-based experimental study was conducted from April to December 2023 in the Burji District of southern Ethiopia. The experiments took place at the Regional Agricultural Office of the Veterinary Laboratory. The study protocol was approved (Ref No. 16.28/2023) by the appropriate institution and adhered to relevant guidelines and regulations, including obtaining consent and approval from participants. A simple random sampling technique was employed to select a total of 360 chickens from the Burji District for a comparative study. The collected data were entered and managed using Microsoft Excel 2010, and statistical analyses were carried out using SPSS software, version 20. A statistical difference was considered significant when $p \le 0.05$. The study demonstrated that leaf extracts of *Tephrosia Vogelii* were effective in the removal of fleas from the surface body of chickens in 48 hours from the first day of treatment. The one-way ANOVA showed that there was a significant difference between and within dependent variables in the mean onset of time ($p < 0.05$). The Multiple Comparison Tests (MCT) identified that diazinon (mean difference = 6.62) and T. vogelii (mean difference = 12) have a faster onset to kill fleas as compared to used Cissus quadrangularis. The medication adverse effect due to diazinon treatment was the highest (23 chickens (19%)), followed by Cissus quadrangularis (11 chickens (9%)) and 5 chickens (4%) of *Tephrosia Vogelii* leaf extract in the experimental trial. The study found that leaf extracts from Tephrosia vogelii were the most effective treatment for chicken fleas. The findings highlight the significant role of locally accessible ethnobotanical plants in preventing poultry ectoparasites within veterinary health services. However, the study did not explore the chemical markers of the active ingredients in these leaf extracts using various analytical techniques, which would provide therapeutic evidence. Therefore, to establish documented ethnoveterinary therapeutic knowledge in the future, a comprehensive laboratory-based clinical trial that is inclusive and representative may be necessary.

INTRODUCTION

In Ethiopia, ectoparasite is a common cause of health issues for chickens. In particular, when using scavenger management techniques, the parasites' infectious stages are processed and took up outside (Bowman, 2008). These parasites compete with the birds for nutrients; some suck blood causing anemia, while others cause anorexia or death (Tadesse, 2012). While some ectoparasite play a crucial role in the spread of specific infections, others can result in illnesses including depluming and scaly legs (Hinkle and Corrigan, 2020). Severe parasite burdens have been recorded in indigenous chicken in southern Ethiopia (Zeryehun and Yohannes, 2015).

The burden of parasites hinders proper growth of the chicken production and productivities (Moyo and Masika, 2013a). This results in decreased egg production and hatchability as chickens typically leave eggs following an ectoparasite infestation. As optional treatments, the concept of Ethno-veterinary medicine (EVM) embarked for conventional animal health care that includes knowledge, skills, practices, and procedures (Isabirye and Mecleod, 2015). Giving farmers access to information that has already been produced within the community is the primary goal of developing ethnoveterinary medicine in rural settings. Most of the time, traditional modern medicine is practiced alongside ethnoveterinary medicine (Lulekal et al., 2014). Because of the growing reliance on modern medicine, there is a risk of losing the expertise and the native livestock disease control system. Farmers in Ethiopia frequently employ ethnoveterinary medicine to treat a variety of livestock ailments (Begum and Sehrin, 2011, Yirga et al., 2012).

Flea infestations cause irritation, restlessness, severe skin infections, reduced productivity and either mild-to-severe anemia occasionally resulting in chicken death (Belihu et al., 2009). Fleas (*Echidnophaga gallinacea*) are a broad-based parasite of chickens that can cause ulcerations on soft body parts, like the comb and wattles (Moyo and Masika, 2013a). This parasitic infestation is negatively affects free range chickens. This flea problem is especially prevalent in developing nations because management measures are implemented erratically (Portugaliza and Bagot, 2015). Previously published literature highlighted the need of regular management practice for the prevention of flea infestation due to weak monitoring system. Study conducted by (Moyo and Masika, 2013a). The control of flea infestations poses significant challenges to the poultry production system. To address this issue, several options are available, including locally sourced herbal medicines such as Tephrosia vogelii and Cissus quadrangular found, as well as synthetic pesticides like carbaryl, permethrin, diazinon, and dichlorvos sre frequently used. However, using these synthetic pesticides has several disadvantages, such as the target organism developing resistance, cost and market availability (Reddy and Reddy, 2015).

The productivity of poultry is hindered by the emergence of a helminthicand ecto-parasite burden. The majority of antihelminthics work by either inhibiting the growth or eliminating these helminths (Patel et al., 2018) In the field of poultry farming, insecticide medications are exhibiting resistance in combating tick infestations. For example, the report from Brazil revealed that the ticks, which were exposed to six different commercial insecticides, demonstrated varying levels of effectiveness in tick removal. Notably, the active principle Diazinon exhibited a lower efficiency rate of 70.71% in eliminating ticks (Pazinato et al., 2014). For this result, plant-based antihelminthics are becoming more popular for use in poultry since they are thought to be safer than synthetic compounds. Therefore, for the treatment of parasites, ethno-veterinary medicines can be utilized instead of commercial insecticides (Mwale and Masika, 2009).

Resource-constrained farmers have discovered that ethno-veterinary treatments work well to reduce external parasites; although, further in vivo testing is required to confirm the efficacy of medicinal plants (Sanhokwe et al., 2016). Most of traditional healer uses botanical medicines however, there is lack of evidence that demonstrate the therapeutic effect of a given medicines through phytochemical analysis. As evidence Sarasan *et al* in 2013 mentioned that, traditional use does not have the capacity to determine effectiveness prior to use (Sarasan et al., 2011). As a result phytochemical analysis is an important tool for the selection of elite provenance of plant material, and should be used for the identification of effective T. vogelii provenances prior to propagation (Sarasan et al., 2011).

Pharmaceutical drugs are typically formulated to induce a particular response, and their side or adverse effects are commonly weighed as a risk in comparison to the primary effect's benefit. On the other hand, herbal medicines often exhibit multiple broad and complementary actions on physiological systems simultaneously, generally aligning with the same therapeutic objective, and are frequently nonspecific (Hajian, 2013, Kazemipoor et al., 2012, Rafieian-Kopaei, 2013). Moreover, these actions seldom result in adverse effects. The actions of herbal medicine are intricate and challenging to accurately assess in terms of their potential for adverse effects (Ekor, 2014, Chiarioni et al., 2023). To date, there has been no comparative study conducted in Ethiopia to assess the impact of contemporary pharmaceuticals in comparison to Ethno-veterinary botanical medicines in order to establish their safety profile. Consequently, the study endeavor involved gathering samples from nearby farmers who cultivated Tephrosia and Cissus quadrangular in their agricultural plots and utilized it for non-edible purposes in an experimental trial. Thus, the objective of the study was to assess and contrast the medicinal effects of diazinon, *Tephrosia vogelii*, and Cissus quadrangular for the treatment fleas on infected chickens.

MATERIALS AND METHODS

Study Setting, and period

The samples were collected from Burji District in the southern part of Ethiopia from April to December 2023. The experiment of the study was conducted in the regional agricultural office's veterinary laboratory of the Southern Nations Nationalities and Peoples Regional State (SNNPRS). It is located about 535 km from Addis Ababa in the south-western direction and borders Oromia Region to the east and south, Amaro Woreda to the north, and Konso Woreda to the west. Administratively, the District is divided into 25 peasant associations, of which 23 are rural peasant associations and two are urban. The population of the District is estimated to be 57,949 and composed of about equal proportions of males and females (i.e., 49.57: 50.43), respectively (Guyo and Tamir, 2014). The populations reside in the different agroecological zones and live on sedentary agriculture, growing different varieties of crops with a mixed of animal husbandry. An estimated 84,886 chicken livestock populations were found in the district (Guyo and Tamir, 2014).

Study population, and sources

Chickens sourced from the Burji District during the research period served as the subjects for comparative analysis. For the purposes of this investigation, both local and exotic chicken breeds managed under a litter system were utilized. The animals employed for this experimental study were obtained from a privately owned farm following informed consent.

Collection, identification and preparation of plant materials

The plant (Fig. 1) is located in Burji Woreda, which is situated latitudinally at about 5°30' N, longitudinally, 37°50' E, and at an altitude of 2057 meters (6749 feet). Ecologically, the area lies in a moderately wet land ecosystem, and the area has bimodal rainfall. The main rains, locally known as Yabla (April-June) and the small rains, locally known as Hagaya (September-November), receive a mean annual rainfall of about 800–1194 mm of rainfall per year. The identity of the plant sample was authenticated at the Regional Agricultural office by a botanical specialist, and the specimens should be preserved for further references.

Study design

The study protocol was designed using methods validated from published articles in peer-reviewed journals, which allowed the investigator to translate the conceptual hypothesis into an operational approach. An experimental study was selected in order to compare the mean onset of killing the fleas from the host body and the side effects on the host (Djouaka et al., 2007, Arends and Robertson, 2005).

Sampling Methods

The study's objective was conveyed to the privately owned chicken owner using a direct approach. The chicken owner subsequently provided a maximum number of flea-infested chickens to the animal health experts in the Woredas. A sample of 360 chicken populations was selected using simple random sampling. These study animals were then randomly divided into three experimental groups. Then, a randomized clinical trial was carried out on a total of 360 chickens (Diazinon = 120, T. vogelii = 120, and Cissus quadrangular = 120).

Study variables, and Experimental Procedures

The study included diazinon, Tephrosia vogelii, and Cissus quadrangular, which were considered independent variables, and the onset of killing fleas and the adverse effect of the product on the host were used as dependent variables.

Experimental procedure for Diazinon

First, a concentrated Diazinon solution (60%) was diluted at a ratio of 1:1000, and then a piece of cotton was immersed in the diluted Diazinon solution. Following this, the solution was applied to the affected areas of the chicken's body where stick-tight fleas were present (such as the comb, wattle, and around the neck region). The process involved documenting the commencement of flea eradication from the body and monitoring any potential side effects on the host (Gadzirayi et al., 2009).

Experimental procedure for Tephrosia vogelii

After removal of any dust particles and washing, the fresh leaves of Tephrosia vogelii were crushed using a meat mincer (No. 10, Shandong Branch, China). Then, the concentrations of the extracts were determined on a weight per volume basis to obtain a concentration in the range of 10, 25, 50, and 75% (w/v). The crushed test materials were squeezed to obtain 100% concentration extracts. The solution was stored at room temperature overnight and later strained using a muslin cloth and filtered using a Whatman No. 1 filter paper, respectively. The filtrates were stored in capped, labeled bottles and kept in the refrigerator at 6°C until use. Finally, the onset of the *T. vogelii* (Fig. 1) solution on killing the fleas from the body and its side effects on the host were noted (Arends and Robertson, 1986).

Experimental procedure for Cissus quadrangular

Cissus quadrangularis has traditional medicinal uses, including applications in livestock, but there is limited scientific evidence confirming its effectiveness against ectoparasites in chickens and for treating worm infestations. Collect fresh Cissus quadrangularis stems and leaves and wash them thoroughly with clean water to remove dirt and contaminants. Chop the stems into small pieces and crush them using a mortar and pestle or a blender. In the study, after each product was applied to the treatment group, researchers investigated the effectiveness of the treatment in eliminating fleas from the chickens' bodies and any adverse effects on the hosts. To avoid bias, a uniform management system was employed, using a group of free-range poultry that was allowed to search for feed and water independently. During the study, in order to avoid bias, a uniform management system group (free-range poultry, searching feed and water by themselves) was selected (Djouaka et al., 2007, Arends and Robertson, 2005).

Data analysis

The experimental part of the data was first entered and managed in a Microsoft Excel 2010 version and analyzed using the statistical package for social sciences (SPSS) software version 20. A statistical comparison using a one-way ANOVA was employed to signify the mean difference between the Diazinon, *Tephrosia Vogelii*, and Cissus quadrangularis when $p < 0.05$. After a one-way ANOVA, Post hoc test using multiple comparison tests (MCT) were done in order to identify which mean was different from the other. The onset of study groups on the host was recorded through time to compare the rate of healing the infested chickens from fleas. Finally, the result of the study displayed was through $\text{Mean} \pm \text{ Standard error}.$ The mathematical model that describes the relationship of the response (the onset of killing fleas and the adverse effect of the product) and treatment (diazinon, Tephrosia vogelii, and Cissus quadrangularis) for the One-way ANOVA is given by Eq. 1:-

$$Yij = \mu \ + \tau \, i + \epsilon ij \qquad (1)$$

Where;

Yij = the j^{th} observation(j = 1,2…..ni) on the i^{th} treatment(i = 1,2…..,k levels), μ = is the common effect for the whole experiment.

RESULTS

Time to Flea Mortality: The present study indicated a clear effect on flea mortality at each treatment interval for diazinon, T. vogelii, and Cissus quadrangularis. The time to onset of flea mortality at each observation point was categorized into three groups: 24 hours (very fast), 36 hours (moderately fast), and 48 hours (delayed).

The current study divided the observation period into 24, 48, and 72 hours to discern the differences in treatment efficacy and to reach definitive conclusions. Following the application of the three acaricides, the onset of flea elimination on the chickens was observed. In each treatment group, the number of chickens rendered free of flea infestation was recorded at 24, 48, and 72 hours. This data enabled the determination of which acaricides exhibited the most rapid effect in treating chicken fleas. Our findings indicated that by 48 hours post-application, both Diazinon and T. vogelii demonstrated effectiveness in flea mortality, whereas Cissus quadrangularis showed lower efficacy.

To determine whether or not there was a significant difference between and within dependent variables, the One-way ANOVA was utilized. Accordingly, the result revealed a significant difference in the mean of onset between and within the variable of interest ($p < 0.05$) (Table 1).

Table 1
ANOVA for testing time onset of killing flea's infestation on poultry

Target groups	Sum of Squares	Df	Average Mean Square	Level of significant
Between Groups	114	**2**	**57**	**0.001**
Within Groups	58	**6**	**9.66**	**0..001**
Total	172	**8**	**66.6**	

After a one-way ANOVA, further multiple comparison tests (MCT) were done in order to identify which mean was different from the other. It was identified that diazinon (mean difference = 6.62) and T. vogelii (mean difference = 12) have a fast onset to kill fleas as compared to used Cissus quadrangularis. There were mean differences observed in the target groups; however, they are the same difference in reverse order. As can be indicated in Table 2, there was a significant mean difference in the onset of action of killing fleas between Diazinon and Cissus quadrangularis ($p \leq 0.05$), and *T. vogelii* and Cissus quadrangularis ($p \leq 0.05$). It implies that Diazinon has a faster onset than Cissus quadrangularis. Also, *T. vogelii* has a faster onset for killing fleas than Cissus quadrangularis. Diazinon and *T.vogelii* have the same onset of killing, according to multiple comparison tests (Table 2).

Table 2
Drugs testing time onset of killing flea's infestation on poultry.

Types of Drugs	Applied comparing drugs	Mean difference	Standard error	Significant	95% confidence Interval	
					Lower bound	Upper bound
Diazinon	*T.vogelii*	-4.200	5.66	0.628	-12.43	3.46
	Cissus quadrangularis	6.62	5.66	0.034	-0.86	14.57
T.vogelii	Diazinon	4.200	5.66	0.628	-3.46	12.43
	Cissus quadrangularis	12.38	5.66	0.001	4.26	20.32
Cissus quadrangularis	Diazinon	-6.62	5.66	0.034	-14.57	0.86
	T.vogelii	-12.38	5.66	0.001	-20.32	4.26

Adverse effect on the chicken body part of the three product outcome of the pre-assessment revealed that the chickens exhibited no signs of swelling, bruising, lesions, or scab formation. To assess the harmful effects of the medications, the chickens in each experimental group were evaluated after medical application. Visual inspection and palpation can be used to assess the skin and any obvious lesions on body parts associated with product treatment. Any negative effects on the chickens could be detected for up to a week. Swelling around the comb and wattle, bruising, and lesion and scab formation were among the side effects of the products used. Adverse effects of Diazinon: from 120 chickens on which the diluted Diazinon was applied, 19% showed moderate swelling around the comb and wattle, a lesion on the skin, and a visible scab at the end of the week.

Also, adverse effects of *T. vogelii* were observed in 120 chickens in the experimental trial of a solution of T. vogelii leaf applied to 5 chickens, which showed slight swelling around the comb and wattle and a lesion on the skin at the end of the week. No chicken had died, and severe illness showed due to the application of this solution to the chicken's body. Additionally, the adverse effects of Cissus quadrangularis after application on 120 chickens (11 chickens, which were 9%) showed slight swelling on the comb and wattle, a lesion on the skin, and a scab at the end of a week. The chicken had severe pain and died due to the application of this solution.

DISCUSSION

The study attempted to enlighten scientific knowledge about ethnoveterinary practice in order to develop viable treatments and measure the interventions that were applied in order to alleviate commercially available drug difficulties (Chapman and Jeffers, 2014, Gaucher et al., 2015, Abbas et al., 2014, Aworh et al., 2019) in chicken farmers. Chicken production plays a crucial socioeconomic role in developing nations. Poultry production, as a sector of livestock production, makes a substantial contribution to the production of food for human consumption (Melesse, 2014, Akinola and Essien, 2011). In most parts of Ethiopia (Asresie et al., 2015), consumers have high preferences for poultry products. This may be due to poultry products provides proteins of high biological value (Lasekan et al., 2013). The chicken population in Ethiopia is estimated to be approximately 56.06 million, with 88.19 percent being indigenous breeds, 6.45 percent hybrid breeds, and 5.36 percent foreign breeds (Sime, 2022).

Despite the economic and consumption significance of chickens in Ethiopia, flea factors have challenged chicken production and performance throughout the entire country. Disease outbreaks contributed to a sense of vulnerability among poultry farmers in the study area of Yemane N et al. 2016 research, affecting 30.1% of respondents (Yemane et al., 2016). The literature suggests that the prevalence of Ecto-parasites in the chicken production system is significant in Ethiopia (Mata et al., 2018). A study conducted in Ambo, Ethiopia, revealed a prevalence rate of 67.95% (265/390) for ectoparasites. The study identified five species of ectoparasites belonging to three orders: Phthiraptera (lice), Siphonaptera (flea), and Mite. The prevalence rates for pediculosis, flea infestation, and mange were recorded as 52.1%, 44.36%, and 34.62%, respectively (Tamiru et al., 2014). Consequently, there has been a significant rise in the utilization of veterinary acaricides for the management of flea infestations (Marchiondo et al., 2013, Sparagano and Ho, 2020). Diazinon is one of the significant acaricides employed to prevent fleas in the chicken health environment (Pfeffer and Heath, 2010). This drug works by altering normal neurotransmission within the nervous system of target organisms, which inhibits the enzyme acetylcholinesterase, which hydrolyzes the neurotransmitter acetylcholine (ACh) in cholinergic synapses and neuromuscular junctions (Ola-Fadunsin et al., 2019). Acaricides are chemicals used to control ticks, but the excessive use of these chemicals accelerates ticks resistance (Vudriko et al., 2018).

The development of tick resistance to acaricides has played a significant role in driving the demand for new products. To determine the effectiveness of chemical acaricides, trials can be conducted either in vitro or in vivo, enabling the selection of the most suitable acaricides (Adenubi et al., 2018) (Nyabongo et al., 2021). The prevention of tick-borne diseases has been facilitated by the advancement and implementation of acaricides. Nevertheless, over time, tick species have developed resistance to acaricides as a result of their adaptive abilities (Obregón Alvarez et al., 2020).

The use of Cissus quadrangularis as a cost-effective alternative to expensive commercial acaricides is widespread among private and small-scale chicken producers. However, the effectiveness of Cissus quadrangularis against significant flea infestations in chickens has not been thoroughly evaluated through scientific experiments (Moyo and Masika, 2013a). Despite the fact that Cissus quadrangularis showed effectiveness against fleas, have potential toxic effects in animals and are also environmental contaminants (Moyo and Masika, 2013b). This particular risk pushes a transition towards readily available ethnobotanical remedies for addressing flea infestations within the chicken health management system. *Tephrosia Vogelii* is considered one of the most effective choices in Ethnobotanical medicine for preventing fleas in the poultry industry. According to the available literature, extracts from the T. vogelii plant exhibit remarkable acaricidal properties against ticks, resulting in 100%

mortality of *Amblyomma variegatum* within 24 hours. Furthermore, these effects persist for a duration of 8 days (Siame, 2016). The initial step involves adding water to the powdered leaf extracts, followed by washing the affected areas with the resulting mixture (Isabirye and Mecleod, 2015). One of the main side effects of this medicinal plant is poisonous to fish, causes itching if exposed to skin (Isabirye and Mecleod, 2015)

The current study showed that the use of diazinon, *T. vogeli*, and Cissus quadrangularis has a significant effect on the time it takes to kill poultry fleas. A study from Uganda confirmed that diazinon and used Cissus quadrangularis had a significant change in time onset to kill fleas in free-range poultry (Isabirye and Mecleod, 2015). As the study evidenced, the Cissus quadrangularis used at treatment for fleas supported the idea that water repellent agents like paraffin oil, petroleum jelly, and kerosene used by the farmers locally were effective in treating the poultry fleas. Where ectoparasitic drugs are not easily available and are also reported, these water repellent agents have some adverse effects on the poultry's skin, including allergy, comb and wattle swelling, and facial scab around the eye (Moyo and Masika, 2013a).

Additionally, the study revealed that there was a significant mean difference in time onset to kill the fleas between Diazinon and *T. vogelii* and Cissus quadrangularis, which means both drugs (Diazinon and *T. vogelii*) have a faster onset to kill poultry fleas than Cissus quadrangularis. Secondly, the side effects on the chicken of each product were not similar, with diazinon getting the first rank, followed by used Cissus quadrangularis, and T. vogelii having the least side effects. With strict follow-up, any side effects observed on them disappeared after two weeks. This suggested farmer should use these economically cheap ethnobotanical plants for treatment of flea infestations. Similar scientific suggestions were forwarded from Uganda that support the present study (Isabirye and Mecleod, 2015).

Chicken that has been treated with diazinon develops adverse effects on the second day of treatment, and the main effect was swelling of the comb and wattle earlier. The swelling changed to a lesion and persisted for more than a week, and the lesion finally changed to a scab form and finally disappeared by itself. On some chickens, depression and a slight decrease in feeding and watering showed. This may be due to the parasite burden and adverse effects of drugs (Permin et al., 2006, Robel et al., 2003). The Cissus quadrangularis caused moderate side effects on the chickens, most of which were observed on the skin, which appeared after a few days. This is because the Cissus quadrangularis is a water-repellent agent and can stay on the smeared area for a long time, and this skin allergy changed to a white scab-like formation and disappeared after a few days. However, it has the potential to remain on the chicken's body for a longer period of time than others. This increased the possibility that the fleas would have more contact with the drugs.

The *T. vogelii* leaf-prepared solution showed good results in both efficacy and side effects. The efficacy (time onset) was similar to diazinon. However, the adverse effect was minimal as compared to diazinon and used Cissus quadrangularis. During observation, after smearing the prepared solution, the poultry showed some irritation, which resulted in scratching and itching. So that little allergy was seen, but a few hours later, irritations and scratching disappeared. Immediately after treatment, a few hours later, this group of chickens was eating and drinking freely until follow-up was completed, and no deaths after treatment appeared in this group.

Limitations and gaps of this study

This comparative evaluation of Diazinon, Tephrosia vogelii, and Cissus quadrangularis for treating fleas in chickens presents certain limitations and identifies areas for future research. Notably, the study does not identify or analyze the specific active chemical components within Tephrosia vogelii and Cissus quadrangularis that contribute to their observed efficacy. Understanding these compounds is crucial for elucidating their mechanisms of action and potentially optimizing their use. Furthermore, while the study evaluates the overall effectiveness of Tephrosia vogelii and Cissus quadrangularis in flea treatment, a more in-depth analysis of their efficacy, considering factors such as dosage, and potential variations in plant potency, was not undertaken.

CONCLUSION, AND RECOMMENDATION

The study found an alternative ethno-veterinary practice for treating flea infestations in chickens. The leaf extracts of *Tephrosia Vogelii* were effective in the removal of fleas from the surface bodies of chickens for up to three days from the first day of treatment. Additionally, diazinon has an equal treatment effect with T. vogelii to kill fleas. However, for farmers, diazinon is not easily available for application, availability, market, or storage. Also, the study noted that an aqueous solution of T. vogelii leaf is the best drug with the lowest number of side effects (4%) in the total population. By taking the minimum side effects, accessibility, and cost into account, the leaf extracts of *Tephrosia Vogelii* had the best treatment effect for poultry farmers. Further investigation is required to determine the active components, standardized doses, timing of plant material collection, and mechanism of action of *Tephrosia Vogelii* for extensive use in Ethno-veterinary settings.

Declarations

Ethical Approval, and Consent for participate

Ethical approval was obtained from Ethics Review Committee of the College of Veterinary Medicine at the University of Gondar (Ref No. 16.28/2023) after the infested animals were donated by the owner for the experimental trail. The study protocol was approved by University of Gondar and conducted as per relevant literature that includes participant willingness and approval references. The experimental animals were infested chickens; there was no violation of animal welfare. The district veterinary officers in charge of animals in the study areas were also informed. Consent to use the animals at all level was gained once upon explaining the objectives of the study. The authors were obtained informed consent from the owner(s) to use the animals for the experiment.

Competing interest**s**

We declare that no conflict of interests in the publication.

Consent for publication

Not applicable

Author’s Contribution

EH performed the laboratory work after collecting the sample in the field. YD oversaw the proposal and provided feedback on the lab's work. AM, BA, YT, and MG prepared the data for analysis, manuscript edition, and data organization. All authors reviewed and approved the final version of the manuscript set-up.

Availability of data and materials

All data was available within the manuscript. If the reader needs additional information with a reasonable request, the corresponding authors can communicate at any time.

Funding

Not applicable

References

1. ABBAS R, COLWELL D, IQBAL Z, KHAN A. Acaricidal drug resistance in poultry red mite (Dermanyssus gallinae) and approaches to its management. World's Poult Sci J. 2014;70:113–24.
2. ADENUBI OT, MCGAW LJ, ELOFF, J. N., NAIDOO V. In vitro bioassays used in evaluating plant extracts for tick repellent and acaricidal properties: A critical review. Vet Parasitol. 2018;254:160–71.
3. AKINOLA L, ESSIEN A. Relevance of rural poultry production in developing countries with special reference to Africa. World's Poult Sci J. 2011;67:697–705.
4. ARENDS J, ROBERTSON S. Integrated Pest Management for Poultry Production: Implementation Through Integrated Poultry Companies. Poult Sci. 1986;65:675–82.
5. ARENDS J, ROBERTSON S. Integrated Pest Management for Poultry Production: Implementation Through Integrated Poultry Companies. Poult Sci. 2005;65:675–82.
6. ASRESIE A, ESHETU M, ADIGRAT E. Traditional chicken production system and marketing in Ethiopia: a review. J Mark Consum Res. 2015;8:27–34.
7. AWORH MK, OKOLOCHA KWAGAJ, MBA E, N., THAKUR S. Prevalence and risk factors for multi-drug resistant Escherichia coli among poultry workers in the Federal Capital Territory, Abuja, Nigeria. PLoS ONE. 2019;14:e0225379.
8. BEGUM A, SEHRIN S. Prevalence and seasonal variation of ectoparasite in pigeon, Columba livia (Gmelin, 1789) of Dhaka, Bangladesh. Bangladesh J Zool. 2011;39:223–30.

9. BELIHU K, MAMO A, LOBAGO F, AYANA D. Prevalence of ectoparasites in backyard local chickens in three agroecologic zones of East Shoa, Ethiopia. Revue de Médecine vétérinaire. 2009;160:537–41.
10. BOWMAN DD. Georgis' Parasitology for Veterinarians-E-Book. Elsevier Health Sciences; 2008.
11. CHAPMAN HD, JEFFERS TK. Vaccination of chickens against coccidiosis ameliorates drug resistance in commercial poultry production. Int J Parasitology: Drugs Drug Resist. 2014;4:214–7.
12. CHIARIONI G, POPA SL, ISMAIEL A, POP C, BRATA DUMITRASCUDI. V. D., DUSE, T. A., INCZE, V. & SURDEA-BLAGA, T. 2023. Herbal Remedies for Constipation-Predominant Irritable Bowel Syndrome: A Systematic Review of Randomized Controlled Trials. *Nutrients*, 15, 4216.
13. DJOUAKA RF, BANKOLE BAKAREAA, DOANNIO HS, KOSSOU JMCM, H., AKOGBETO MC. Quantification of the efficiency of treatment of Anopheles gambiae breeding sites with petroleum products by local communities in areas of insecticide resistance in the Republic of Benin. Malar J. 2007;6:1–6.
14. EKOR M. The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. Front Pharmacol. 2014;4:177.
15. GADZIRAYI C, MUTANDWA E, MWALE M, CHINDUNDU T. 2009. Utilization of Tephrosia vogelii in controlling ticks in dairy cows by small-scale commercial farmers in Zimbabwe. Afr J Biotechnol, 8.
16. GAUCHER M, QUESSY S, LETELLIER A, ARSENAULT J, BOULIANNE M. Impact of a drug-free program on broiler chicken growth performances, gut health, Clostridium perfringens and Campylobacter jejuni occurrences at the farm level. Poult Sci. 2015;94:1791–801.
17. GUYO S, TAMIR B. Assessment of Cattle Husbandry Practices in Burji Woreda, Segen Zuria Zone of SNNPRS, Ethiopia. Intl J Technol Enhanc Emerg Eng Res. 2014;2:11–26.
18. HAJIAN S. Renoprotective effects of green tea. J Nephropharmacology. 2013;2:21.
19. HINKLE NC, CORRIGAN RM. 2020. External parasites and poultry pests. Dis Poult, 1135–56.
20. ISABIRYE R, MECLEOD E. Tephrosia vogelii for control of fleas in free-range poultry. Uganda J Agricultural Sci. 2015;16:29–41.
21. KAZEMIPOOR M, WAN MOHAMED RADZI C, CORDELL, G. A., YAZE I. Safety, efficacy and metabolism of traditional medicinal plants in the management of obesity: a review. Int J Chem Eng Appl. 2012;3:288–92.
22. LASEKAN A, BAKAR, F. A., HASHIM D. Potential of chicken by-products as sources of useful biological resources. Waste Manag. 2013;33:552–65.
23. LULEKAL E, ASFAW Z, KELBESSA E, VAN DAMME P. Ethnoveterinary plants of Ankober district, north Shewa zone, Amhara region, Ethiopia. J Ethnobiol Ethnomed. 2014;10:1–19.
24. MARCHIONDO A, HOLDSWORTH P, FOURIE L, RUGG D, HELLMANN K, SNYDER, D., DRYDEN M. World Association for the Advancement of Veterinary Parasitology (WAAVP): guidelines for evaluating the efficacy of parasiticides for the treatment, prevention and control of flea and tick infestations on dogs and cats. Vet parasitol. 2013;194:84–97.

25. MATA W, GALGALO W, JILO K. Prevalence of the major ectoparasites of poultry in extensive and intensive farms in Jimma, Southwestern Ethiopia. J Parasitol Vector Biology. 2018;10:87–96.
26. MELESSE A. Significance of scavenging chicken production in the rural community of Africa for enhanced food security. World's Poult Sci J. 2014;70:593–606.
27. MOYO S, MASIKA P. 2013a. Efficacy of materials used by resource limited farmers in ethno-veterinary control of fleas in free-range chickens in the Eastern Cape Province, South Africa. Afr J Biotechnol, 12.
28. MOYO S, MASIKA P. 2013b. Insecticidal properties of materials used by resource-limited farmers to control fleas in free-range chickens in the Eastern Cape Province, South Africa. Afr J Biotechnol, 12.
29. MWALE M, MASIKA P. Ethno-veterinary control of parasites, management and role of village chickens in rural households of Centane district in the Eastern Cape, South Africa. Trop Anim Health Prod. 2009;41:1685–93.
30. Nyabongo L, Kanduma EG, Bishop RP, Machuka E, Njeri A, Bimenyimana AV, Nkundwanayo C, Odongo DO, Pelle R. Prevalence of tick-transmitted pathogens in cattle reveals that Theileria parva, Babesia bigemina and Anaplasma marginale are endemic in Burundi. Parasites Vectors. 2021;14:1–15.
31. Obregón Alvarez D, Corona-González B, Rodríguez-Mallón A, Rodríguez Gonzalez I, Alfonso P, Noda Ramos AA, Díaz-Sánchez AA, González Navarrete M, Rodríguez Fernández R, Méndez Mellor L. Ticks and tick-borne diseases in Cuba, half a century of scientific research. Pathogens. 2020;9:616.
32. Ola-Fadunsin SD, Ganiyu IA, Rabiu M, Hussain K, Sanda IM, Musa SA, Uwabujo PI, Furo NA. Gastrointestinal parasites of different avian species in Ilorin, North Central Nigeria. J Adv veterinary Anim Res. 2019;6:108.
33. PATEL T, MARMULAK T, PITESKY GEHRINGR, CLAPHAM M, M. O., TELL LA. Drug residues in poultry meat: A literature review of commonly used veterinary antibacterials and anthelmintics used in poultry. J Vet Pharmacol Ther. 2018;41:761–89.
34. PAZINATO R, KLAUCK V, DALLA GROSSKOPFRK, ROSA L, BARETTA VOLPATOA, STEFANI D. L. M. & DA SILVA, A. S. 2014. Antiparasitic resistance of different populations of ticks (Rhipicephalus microplus) in the Western of Santa Catarina state, Brazil. *Acta Scientiae Veterinariae*, 42, 1–6.
35. PERMIN A, CHRISTENSEN J, BISGAARD M. Consequences of concurrent Ascaridia galli and Escherichia coli infections in chickens. Acta Vet Scand. 2006;47:1–12.
36. PFEFFER A, HEATH A. 2010. The Use of Diazinon as a Veterinary Medicine in New Zealand A Report to ERMA New Zealand.
37. PORTUGALIZA HP, BAGOT MA. Different species of lice (Phthiraptera), fleas (Siphonaptera) and ticks (Ixodida) collected from livestock, poultry, reptile and companion animal in Leyte Island, Philippines. Livest Res Rural Dev. 2015;27:1–10.
38. RAFIEIAN-KOPAEI M. Medicinal plants for renal injury prevention. J Ren injury Prev. 2013;2:63.
39. REDDY PP, REDDY PP. 2015. Sweet potato: ipomoea batatas. Plant Prot Trop Root Tuber Crops, 83–141.

40. Robel RJ, Walker TL, Hagen CA, Ridley RK, Kemp KE, Applegate RD. Helminth parasites of lesser prairie-chicken Tympanuchus pallidicinctus in southwestern Kansas: incidence, burdens and effects. Wildl Biology. 2003;9:341–9.
41. SANHOKWE M, MASIKA MUPANGWAJ, MAPHOSA PJ, V., MUCHENJE V. Medicinal plants used to control internal and external parasites in goats. Onderstepoort J Vet Res. 2016;83:1–7.
42. SARASAN V, SILESHI KITEGC, G. W., STEVENSON PC. Applications of phytochemical and in vitro techniques for reducing over-harvesting of medicinal and pesticidal plants and generating income for the rural poor. Plant Cell Rep. 2011;30:1163–72.
43. SIAME CP. FIELD ASSESSMENT OF THE EFFICACY OF TEPHROSIA VOGELII (HOOK) PLANT LEAF EXTRACTS FOR CONTROL OF TICKS ON NATURALLY INFESTED CATTLE IN NJOLA VETERINARY CAMP OF MONZE DISTRICT, ZAMBIA. University of Zambia; 2016.
44. SIME AG. Review on poultry production, processing, and Utilization in Ethiopia. Int J Agricultural Sci Food Technol. 2022;8:147–52.
45. SPARAGANO OA, HO J. Parasitic mite fauna in Asian poultry farming systems. Front Veterinary Sci. 2020;7:400.
46. TADESSE D. Management practices, productive performances and egg quality traits of exotic chickens under village production system in east Shewa, Ethiopia. Addis Ababa University; 2012.
47. TAMIRU F, DAGMAWIT A, ASKALE G, SOLOMON S, MORKA D, WAKTOLE T. Prevalence of ectoparasite infestation in chicken in and around Ambo Town, Ethiopia. J Vet Sci Technol. 2014;5:104172.
48. VUDRIKO P, OKWEE-ACAI J, TAYEBWA BYARUHANGAJ, TWEYONGYERE DSOKECHSG, WAMPANDE R, MUGABI EMOKURUTARA, K., MUHINDO JB. Chemical tick control practices in southwestern and northwestern Uganda. Ticks tick-borne Dis. 2018;9:945–55.
49. YEMANE N, TAMIR B, MENGISTU A. Constraints, opportunities and socio-economic factors affecting flock size holding in small scale intensive urban poultry production in Addis Ababa, Ethiopia. Agric Biology J North Am. 2016;7:146–52.
50. YIRGA G, TEFERI M, GIDEY G, ZERABRUK S. An ethnoveterinary survey of medicinal plants used to treat livestock diseases in Seharti-Samre district, Northern Ethiopia. Afr J Plant Sci. 2012;6:113–9.
51. ZERYEHUN T, YOHANNES Y. Ectoparasite infestation of free scavenging chickens reared under traditional backyard production system in Wolayita Zone, southern Ethiopia. Ethiop Veterinary J. 2015;19:55–66.

Figures

Figure 1

Photograph of green leaf of Tephrosia.vogelii plant