IULTCS Young Leather Scientist Grant

Identification: YLSG_2021_fitsumetefaahmed

COMPLETE APPLICATION FORM (click application area)

X Basic Research ☐ Environmental/Sustainability

1) Applicant Information

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By submitting this application, I commit to develop the project as outlined in the attached Research Project Plan and to complete a written report by February 28, one year after payment with the following items:

Introduction

Materials and Methods

Results and Discussion

Conclusion

Suggestion for Future Work

References

2) Research Project Plan outline – Maximum 3 pages

Title: **Studying anti-ectoparasitic activity of medicinal plant extracts in terms of reducing cockle damage on sheep and goat skin.**

2.1. Introduction

Leather industry is one of the oldest and the largest industry in the global economy through its massive potential for employment, growth and export earnings (Adem, 2019). Ethiopia used to get the second largest foreign currency earnings from the export of skin and hide (ESGPIP, 2010; Tolossa, 2014). Ethiopian small ruminant skins, especially sheep skins, traditionally have a very good reputation for quality in the world leather market due to their fine grain and compact structure (Abadi, 2000). In general, skins are the most important items to generate foreign currency for developing countries like Ethiopia. However, the huge resource potential of sheep and goat populations of the country are constrained and threatened by compound effect of diseases, poor management and malnutrition. Ectoparasites attack attributed as major causes of skin rejection in the Ethiopian tanneries.

Parasitic skin diseases caused by ectoparasites such as lice, keds and ticks are among the threats resulting in serious economic loss to the tanning industry and the country as a whole (Tolossa, 2014). Ectoparasitic skin diseases causes the major sheep and goat skin rejections at tanneries. Out of the reject groups of the processed skin, about 80% to 90% defects were believed to be due to external parasites (Kebede, 2013, Tolossa, 2014).

Ectoparasitic skin diseases (cockle) results in huge economic loss to tanneries and the country at large since the damage is recognized after a lot of costs incurred on the processing (Kassa, 2006). The estimated financial loss due to drop in quality of sheep and goat skin is around USD 25.8 million per year. As many as one-quarter to one third of all skins processed at tanneries in Ethiopia have various defects and are unsuitable for export purposes where most of these defects occur in the pre-slaughter stage of production while the animals are alive and are directly related to parasitic skin diseases. The extent of the problem has increased continuously during the past few years, threatening the small ruminant population, health, production and reproduction that warrant cost effective control measures (Tolossa, 2014). Ectoparasites can be controlled using commercial drugs (pesticides), but their accessibility and affordability to the poor Ethiopian farmers, and lack of safety of the commercial organophosphorous compounds towards human and environment makes them unattractive for use (Kebede, 2013). Furthermore, Resistance to antiparasitic drugs is such a widespread problem, particularly in livestock. The issue of drug resistance in ectoparasite populations has become increasingly problematic (McNair, 2015). Due to these, despite of the ongoing ectoparasite control activity in the country, problems of ectoparasitic skin diseases of small ruminants is still active and serious in Ethiopia. For instance, in Tigray Regional state, after the realization of the control program an overall ectoparasite prevalence of 55.5% in sheep and 58% in goats were reported (Mulugeta et al., 2010).

2.2. Objective: To identify safe and effective anti-ectoparasitic medicinal plant.

2.3. Materials and Methods

2.3.1. Collection of medicinal plants

Some locally available medicinal value plants such as Calpurnia aurea (leaf), Rumex patientia (root), Allium cepa (bulb), Lupinus albus (seed) and Phytolacca dodecandra (fruit) will be collected in and around Bahir Dar,Ethiopia, and will be identified and labeled by botanist from Bahir Dar University Biology department and then transported to Bahir Dar University Biology department. These collected medicinal plants will be cleaned and shade dried at room temperature and then it will be crushed by using pestle and mortar. The powdered sample will be kept in air tight container and stored at 4ºC until use.

2.3.2. Extraction

The powdered plant materials will be extracted with methanol in similar way with the Kang et al. (2011). Each plant materials' 300 gram will be extracted with 900 ml of 80% methanol in a shaking incubator at 80°C for 12 hr. The residue

will be re-extracted under the same condition three times. The extracts obtained will be pooled and filtered. Then, it will be filtered through Whatman No-1 filter paper.

2.3.3. Phytochemical Screening

All the obtained extracts will then be subjected to different qualitative tests to find out the presence of specific phytochemicals (alkaloids, saponins, flavonoids, etc).

2.3.4. In vitro and in vivo efficacy test

Ectoparasites (sheep keds, ticks and lice) either encountered on the skin surface or attached to the hair will be collected manually from their sites of attachment. A coat brushing technique will applied to collect lice, keds and tick from host skin. Then the collected samples will be placed in labelled universal bottles containing 70% ethanol and will be taken to the Parasitology Laboratory found at Bahir Dar University. All five medicinal plant extracts will be checked first in the in vitro for their ectoparasiticide efficacy with different concentration in the laboratory. Those extracts which are effective in the in vitro test will be used in the in vivo test in the field with their respective concentration. The number of the group will depend on the number of medicinal plant extracts that are effective in the in vitro test. If all extracts are effective in in vitro test, six groups each with 5 animals (small ruminants) will be required. Group 1 (will be treated with Calpurnia aurea leaf extract), group 2 (will be treated with Rumex patientia root extract), group 3 (will be treated with Allium cepa bulb extract), group 4 (will be treated with Lupinus albus seed extract), group 5 (will be treated with Phytolacca dodecandra fruit extract) and group 6 will be left untreated or will be used as positive control. The animals in each group will be assigned randomly. The study design that will be used is field experimental study.

Note: In vivo (field) test will be performed after approval of ethical clearance by Bahir Dar University Research Ethical Committee.

2.4. Hypothesis/Expected Results: Safe and effective ectoparasiticide medicinal plant extract drug will be identified.

2.5. Research benefit for the local or global leather industry (one sentence only): To get adequate quality of sheep and goat skins and as a result enables the production of adequate amount of leather and its products in the leather industry and to reduce production losses of farms due to ectoparasites.

2.6. Literature

2.6.1. Sheep and Goat Ectoparasites

External parasitism results in poor quality sheep and goat products especially skins and lost income to producers. Common external sheep and goat parasites include ticks, lice, keds and mites. Some parasites feed on blood causing blood-loss anaemia, especially in young animals. Ectoparasites are a serious pathogens of sheep and goat industry that cause a significant negative impact in tanning industries and economic growth in Ethiopia (Tulu and Urge, 2018).

2.6.1.1. Ticks

Ticks are one of the most serious ectoparasites in Ethiopia (Tolossa, 2014). They cause the greatest economic losses in livestock production. Their effects are various including reduced growth, milk and meat production, damaged hides and skins, transmission of tick-borne diseases of various types and predispose animals to secondary attacks from other parasites such as screw worm flies and infection by pathogens such as Dermatophilus congolensis, the causative agent of streptothricosis. Other losses directly attributable to ticks include skin damage that greatly lowers value of the skin in Leather processing (ESGPIP, 2010).

2.6.1.2. Lice

Lice are small, dorso-ventrally flat-bodied insects with legs modified for grasping hairs. There are two types of lice which affect ruminants, biting (chewing) lice and sucking lice. Biting lice produce itching, irritation and possible hair loss, whereas sucking lice suck blood and can contribute to anaemia as well as skin irritation. Heavy infestation of lice on sheep can lead to “ekek”/cockle defect, which is an allergic skin hypersensitivity reaction to lice and their saliva in processed sheep skin (ESGPIP, 2010; Tadesse et al., 2011). Cockle is a defect which appears on the grain side of semiprocessed and crust leather after pickling that cannot be detected when the skin is examined before being

processed. It results in huge economic loss to tanneries and the country at large since the damage is recognized after a lot of costs incurred on the processing (Kassa, 2006). Lice are easily overlooked because of their small size (Kassa, 2006; ESGPIP, 2010).

2.6.1.3. Sheep Keds

Sheep ked, commonly known as sheep ticks, is adult hairy wingless brown six legged flies about 6 -7 mm long. They are permanent ectoparasite and feed on blood. They transfer from animal to animal through direct contact. Sheep ked can live up to 6 months, during which time the female produces around 10 to 15 young ones every eight days continuously. But, unlike most insects, a female ovulates a single egg that hatches into maggot-like larvae (ESGPIP, 2010).

2.7. Hypothesis/Expected Results:

-Biological anti-parasite control would offer a cheap and environmentally friendly alternative to the use of chemical insecticide and acaricide drugs.
- Farmers will have a better understanding of the issues that come with high infestation levels and control methods.
- Improved skin quality and foreign currency revenues from skin exports.

2.8. Research benefit for the local or global leather industry (one sentence only):

-Provide alternate anti-ectoparasite medications that benefit farmers & leather manufacturer productivity.

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