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Original article

A survey of external parasites of free-range chickens and their ethno-veterinary control remedies used by resource-limited farmers in Eastern Cape, South Africa

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ABSTRACT

In most rural areas, chicken infestation with external parasites poses a challenge to their productivity and associated benefits. External parasites cause anemia, thus reducing growth, egg production and may lead to death. They are mainly controlled by commercial remedies, although resource-limited farmers resort to using alternative remedies which are available and affordable. This study was conducted to document external parasites of free-range chickens and their ethno-veterinary control remedies used by resource-limited farmers. A questionnaire survey was conducted amongst 93 households, 3 of which were herbalists, in Eastern Cape, South Africa. The farmers considered several external parasites to be a problem: mites (79.6%) stick tight fleas (64.5%), lice (10.8%) and ticks (6.5%). Various ethno-veterinary remedies were used to control the parasites, which included ash (28%), madubula (26.7%) and Jeyes fluid (10%) both of which are comprised of 13% carbolic acid, paraffin (8.4%), plants (5.2%), used engine oil (2.8%), dip wash (2.5%), doom spray (d-phenothrin 0.4%), blue death (permethrin 0.03%) (1.9%), diesel (1.9%), smoke (0.9%) and a few (4.2%) used conventional insecticides namely karbadust (carbarly 5%) and

mercaptothion 5%). A small proportion (7.5%) does not use either of the remedies. The materials used by resource-limited farmers in controlling parasites were identified and documented.

1. Introduction

Free-range chickens constitute a significant contribution to human livelihoods and contribute significantly to food security of poor households (Gondwe, 2004). However, external parasites undermine and limit chicken productivity and associated benefits by sucking blood, causing aneamia, reducing egg production, growth, affecting feed efficiency, emaciation, and ultimately leading to death if not controlled. The high incidence of external parasites is a major constraint in South Africa (Wilson, 1986). Various external parasites have been reported in the free- range chickens, the most common ectoparasites in South Africa included mites, fleas, lice and the tick (Mashishi, 2002). They also cause chick mortality attributed to starvation and immune depression under heavy infestation. Parasitism ranks high among factors that threaten chicken production in South Africa (Thekisoe et al., 2003). More so, some of the external parasites, especially tick and mites, are vectors of other poultry diseases such as pastuerellosis, fowl pox, newcastle and possibly chlamydia (Nnadi and George 2010) This highlights the economic importance of external parasites in free-range chickens in the study area and South Africa in general. In most of the developing countries like South Africa inappropriate housing and lack of appreciable pest control efforts also lower their productivity potential because of parasitic infestation (Mungube et al., 2006).

Ideally external parasites of chickens are controlled using commercial remedies, however, these tend to be rather expensive and out of reach of resource-poor farmers (Gueye, 1997). In many developing countries, resource-limited farmers have resorted to the use of ethno-veterinary materials to treat and control livestock parasites. This is mainly attributed to inefficient poor veterinary health care systems due to poor staffing and to veterinary drugs being too expensive for farmers (McCorkle, et al., 1996). Knowledge of ethno-veterinary medicine (EVM) like any other traditional knowledge system is transmitted orally from generation to generation (McCorkle et al., 1996) and it is disappearing because of rapid socio-economic, environmental and technical changes. This therefore, calls for the urgent need to document local knowledge of ethno-veterinary healing and conserved before it is lost forever. This study was therefore conducted to document external parasites of free-range chickens and their ethno-veterinary control in the rural areas of Amatola basin in Eastern Cape Province, South Africa.

2. Materials and methods

2.1. Study area

Amatola Basin is found in the Amathole District of the Eastern Cape Province of South Africa. It has 13 villages, out of which 7 participated in the study. The area has an altitude of 1 807m above sea level, and lies within latitude 32° 31.00 - 32º 45.00 S and longitude of 26° 57.00 -27º 02.00 E on the Eastern slopes of the Amatola mountain range (Bembridge et al., 1982). The average summer daily minimum temperature range from 19-23°C and the maximum range is 28-31°C. It receives an average annual rainfall of 580-800mm (ISCW, 2008).

2.2. Sampling procedure

Villages under study were randomly selected and subsequently households that keep chickens were identified using the snowball sampling technique, where we had to ask respondents to give referrals to other persons believed to fit the study requirements. We continued requesting for referrals until we reached our target. Interviews were conducted amongst 93 chicken farmers, three were herbalists.

2.3. Data collection

Data were collected through the use of questionnaires. Questions on problematic parasites, their description and their control measures were asked. Three herbalists were consulted on plants used in the control of parasites. Plant samples were collected with the aid of herbalists and farmers, they were further authenticated at the Albany

Herbarium in Grahamstown, voucher specimens prepared and deposited in the Giffen Herbarium at the University of Fort Hare.

2.4. Statistical analysis

The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS, 2003). Descriptive data were computed.

3. Results

The majority of respondents (97.8%) acknowledged external parasites to be a problem in their chickens. Common among the parasites perceived to be a problem were mites Dermanyssus gallinae (79.6%), fleas Echidnophaga gallinacea (64.5%), lice Menacanthus stramineus (10.8%) and ticks Argas persicus (6.5%), all of which are reported to be more frequent during summer. Mite infestations especially during periods of high temperatures, such as in summer were reported to contribute to the high incidences of egg abandonment by incubating hens. This is perceived by 50% of the respondents to explain why their chickens produce fewer chicks during summer. Few farmers (30%) did not have separate shelter for the chickens, but accommodated them in their houses. There was a number of ethno-veterinary control remedies used to control external parasites (Table 1). A few farmers (4.2%) used commercial drugs which included carbaryl 5% and mercaptothion 5%. Only few plants were also used in the control of external parasites (Table 2). The alternative remedies used in the control of external parasites were applied in different ways. Used engine oil and paraffin were brushed externally on the chicken feathers and the skin without being diluted. Jeyes fluid and madubula (Carbolic acid 13%) were diluted as per the manufacture's instructions, to make a solution in which the chickens are dipped. The remaining solution was used to disinfect the fowl runs.

4. Discussion

The study revealed external parasite infestations in chickens to be a major concern during summer when conditions are conducive to the breeding of parasites, as also reported by (Mungube et al., 2006). Parasites perceived to be problematic in this study were similar to those previously reported by (Permin et al., 2002). This could be due to external parasites of free-range chickens being common in the tropics where the standard of husbandry is generally poor and climatic conditions are favourable for their development (Phiri et al., 2007). Some farmers did not provide appropriate housing for their chickens, due to having limited resources. As a result they shared houses with chickens, in an attempt to protect them and the eggs from predators and theft. However, they acknowledged the need to provide shelter for their chickens. Sharing accommodation especially with incubating hens leads to external parasites like mites, fleas, ticks and lice parasitizing humans too (Mungube et al., 2007; Soulsby, 1982) thus causing cutaneous reactions such as popular dermatitis and urticaria (Beck, 1999).

Mite infested chickens especially during the hotter periods of the year, were perceived to be the main cause of incubating hens to abandon eggs. This is a phenomenon also reported in an earlier study (Gordon and Jordan, 1982), which is attributed to parasites causing distress and discomfort to the chickens (Mungube et al., 2007). Broody hens tend to leave eggs before they are hatched hence leading to low hatchability and ultimately reduced production. Therefore farmers resort to selling or eating the eggs rather than losing them through decay. Farmers in this study isolate chickens coming from outside their flocks by housing them separately and giving them feed for some days, this is a practice also documented by Mungube et al., (2007). Generally, isolation of chickens new to the flock is done to observe those that might show signs of disease or parasites which are treated. As a result this minimizes the risk of transmitting diseases and external parasites to those chickens which are not infected or infested.

The majority of farmers in this study, many of whom depend on government pensions, are unable to buy commercial drugs hence they use alternative remedies. Jeyes fluid (Adcock Ingram, Bryanston South Africa) one of the most widely used is a commercial product, used as a household disinfectant. It contains mainly tar acids-13% m/m (carbolic acid) and sodium hydroxide 1%). Carbolic acid is noted to be an antiseptic and disinfectant (Baker, 2008). In addition, Jeyes fluid is corrosive with a potential to cause adverse effects on skin and eyes. With prolonged and repeated skin contact it may result in irritation, skin dermatitis, blisters and burns (Baker, 2008). As a result Jeyes fluid should be used with care taking into account the aforementioned effects.

Table 1
Ethno-veterinary control of external parasites control of free range chickens.

Method	Application method	% of farmers who used the method
Cold/hot ash	dusting	28
Madubula (Carbolic acid 13%)	dipping	26.7
Jeyes fluid (carbolic acid 13%)	dipping	10.8
Paraffin	smearing	8.4
Plants	dipping	5.2
Used engine oil	smearing	2.8
Dip wash	dipping	2.5
Doom Spray (d-phenothrin 0.4%)	spraying	2.4
Blue death (permethrin 0.03%)	spraying	1.9
Diesel	smearing	1.9
Smoke	smoking	1.9
Not using anything	-	7.5

Table 2
Plants used in controlling external parasites of chickens in Amatola Basin.

Family/Scientific name	Common/ local name	Part used	Preparation method	Route of administration
Asteraceae Tagetes minuta	Mexican marigold/unukanuka	leaves	Crushed and soaked in water over night (infusion)	Dipping
Fabaceae Calpurnia aurea	Natal laburnum/umhlahlampetu	leaves	Crushed and soaked in water overnight (infusion)	Dipping
Euphorbiaceae Cultia pulchella	Warty-fruited clutia/umbheza	leaves	Crushed and soaked in water overnight (infusion)	Dipping

The non-plant materials used in the control of external parasites in the present study are similar to those in a study done in Botswana (Moreki et al., 2012). In Zimbabwe Muchadeyi et al. (2004) reported that farmers used paraffin topically to control fleas on the infested area. The remedies which are applied by rubbing or smearing tend to have a direct contact with the parasites. Despite its being used, farmers in this study cautioned the use of paraffin. This is due to the fact that it burns the skin (Mattorano et al., 2004) and causes severe eye and skin irritation, on humans as also reported by (Loden, 2005). As a result caution should be practiced when using it.

Doom spray (d.phenothrin 0.4%) (Tiger Consumer Brands Limited, Bryanston South Africa) was also used to control free-range external parasites in this study. D-phenothrin is a type 1. Pyrethroid with a low level of toxicity registered for use against external parasites that affect humans and animals (Go et al., 1999). A study by Murugaiyah, et al. (2004) reported that d.phenothrin 0.4% had an efficacy of 90% against ticks. Pyrethroids are considered to be axonic poisons in insects they block transmission of pulses along axons and eventually cause paralysis in insects being controlled Price et al. (2002).

Blue death (permethrin 0.03%) (Bryanston, South Africa) is a broad spectrum synthetic pyrethroid insecticide used against a variety of insects. It kills insects on contact by exciting their nervous system making it very sensitive to stimuli from sense organs (Baser et al., 2003). The permethrin's mode of action results in controlling external parasites of free range chickens. However, in a study conducted by Haustein et al. (2002) permethrin was reported to be used in the treatment of head lice. According to Spencer et al. (2003), permethrin has an effective repellent activity against mosquitoes and flies. Permethrin binds to sodium channels causing a slowing of their rate of closure resulting in repetitive firing of nerves, depolarization and nerve block (Mervyn, 2004). Permethrin 0.03% has a low to moderate persistence in the soil environment and is readily degraded in soil and water (Spencer et al., 2003). As a result its use in the control of external parasites can be recommended.

In addition, farmers also used, used engine oil to control external parasites in chickens. As previously reported, used engine oil is effective in controlling cattle ticks (Moyo and Masika, 2009; Mbati et al., 2002). Used engine oil contain some contaminants such as lead, magnesium, copper, zinc, chromium, arsenic, chlorides, cadmium and polychlorinated biphenyls (Chin et al., 2012). It is estimated that one quart of used engine oil can pollute 62 500l of drinking water and can pollute 3.75 m2 of soil , making it non-productive for farming or plant growth for up to 100 years (Chin et al., 2012). Considering the side effects of used engine oil its use should not be promoted.

Three plants were found to be used in the control of external parasites of free-range chickens Tagetes minuta, Calpurnia aurea, and Cultia pulchella. Tagetes. minuta is reported to contain α-terpineol, β-ocimene, dihydrotagetone and ocimenone (Moghaddam et al., 2007). Terpens in the T. minuta have toxic effects against mosquitoes (Perich et al., 1995). Also the insecticidal activity of T. minuta has been reported against human lice Pediculus humanus capitis (Ivanice et al., 2004) and is said to possess some repellent properties to external parasites of chickens Okitoi et al. (2007). Tagetes minuta was also reported by Moyo and Masika (2009) to control ticks in cattle in the Eastern Cape, whereas in the current study it was used for controlling any external parasite in free-range chickens.

Farmers in South Africa use the leaves and powdered root of Calpurnia spp. to destroy lice, maggots and to relieve irritation on animals (Adedapo et al., 2008). In the current study farmers used C. aurea (Ait) Benth to control fleas and lice. The extracts of the leaves in particular are used for killing lice and ticks in cattle (Hailu, 2004). It has been found to possess some insecticidal properties (Waka et al., 2004). Different alkaloids of C. aurea have been isolated and these include calpurnine virgiline and virgiline pyrrolecarboxylic acid ester (Isao et al., 1984). These compounds are insecticidal at low concentrations and frequently toxic to external parasites (Isao et al., 1984).

Cultia pulchella has a wide distribution in South Africa and belongs to the plant genus of family of Euphorbiaceae (Terblanche and Van- Hamburg, 2007). Although it was identified as one of the plants used in the control of external parasites in this study, not much information is available in the literature about its insecticidal activities. This plant is mainly known by herbalists, hence most of the farmers are not aware of the plant that it can be used to control external parasites of chickens.

Similar to findings by Swatson et al. (2001) respondents in this study also used wood-ash to control external parasites. As previously reported by (Moreki et al., 2010) the ash is sprinkled in the chicken house hot or cold. Cold ash dust is reported to be more abrasive than ordinary soil dust. It removes the waxy coating of the insect exoskeleton when the bird takes a bath. If enough of the waxy coating is removed, the insect will then dehydrate and die (Sonaiya and Swan 2004). This explains how cold ash controls external parasites. Hot ash is applied when chickens are not in the fowl-run. It would burn any parasite found in the fowl-run, hence reducing the infestation levels (Moreki et al., 2010). Use of ash is one of the common practice implemented by most rural farmers and has been perceived to be effective.

There are several studies particularly in Africa which found that smoke produced from burned materials is effective to drive away external parasites (Karunamoorthi et al., 2008; Seyoum et al., 2002; Lukwa et al., 1999). Smoke is a common method of repelling biting insects that is used worldwide. Fresh or dried plants are frequently added to fire to enhance the repellent properties of the smoke (Karunamoorthi et al., 2008). Lukwa et al. (1999) reported 13% of rural Zimbabweans use plants to enhance smoke to repel external parasites Thirty-nine percent of Malawians burn dung and leaves (Ziba et al., 1994) while in this study almost 1% of farmers used smoke to repel external parasites. A study in Kenya by Seyoum et al. (2002) reported that 100% farmers burned plants to repel mosquitoes. These studies indicated that natural fumigants are extensively used to drive away blood sucking insects across Africa.

Also farmers use cattle-tick dip wash which is a solution of Triatix TR 500 (Amitraz 50 %) and water to control the external parasites of chickens. They collect the dip wash from the communal plunge dip during the dipping of cattle. They immediately submerge the whole chicken's body in the solution. It has been also reported to be highly effective against animal external parasites such as mites and ticks (Young et al., 2005). It is a broad spectrum acaricide widely used for cattle, sheep and goats. It kills the parasites by attacking the central nervous system (Tokman et al., 2009).

The use of diesel to control external parasites has also previously been reported by (Letsoalo et al., 2000) where diesel was applied dermal to treat external parasites of chickens. Light diesel oil is smeared on the infested

site, hence the parasite will be suffocated and die (Letsoalo et al., 2000). However it can be toxic to chickens hence great care must be exercised when using it.

5. Conclusion

The study revealed that the most problematic external parasites of free-range chicken were mites, lice, fleas and ticks as perceived by farmers. To control these external parasites, resource-limited farmers used a wide range ethno-veterinary remedies. The commonly used included ash, Jeyes fluid (carbolic acid 13%), used engine oil, paraffin and a few plants T. minuta, C. pulchella and C. aurea. However, further studies are recommended to be done to determine the existence of the perceived external parasites in free-range chickens and to assess the efficacy of these remedies before their use is recommended.

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