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POULTRY MITE REPELLENT POTENTIALITY OF ESSENTIAL OIL FROM *BLUMEA MOLLIS* (D. DON) MERR

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ABSTRACT

Dermanyssus gallinae possess significant threat to egg laying hens in many parts of the world. Continued use of insecticides may result in mite resistance, chemical residues in food and undesirable environmental effects. Therefore it is the need of the hour to find alternative approaches for controlling *D. gallinae*. The present study aims to extract the essential oil from *B. mollis* and study their bio-activities. Major methodologies adopted were extraction of essential oil by hydrodistillation. In order to study the mite repellent or killing property, *Dermanyssus gallinae* were collected from infected poultry and they were treated with different concentrations of *B. mollis* essential oil dissolved in DMSO (once in a day for a week). A commercial mite repellent Tik -Out was used as standard. The essential oil yielded from *B. mollis* by hydro distillation was yellow in colour, transparent and clear with characteristic medicinal aroma and the yield was 100µl/100g. The observed mite repellent potentiality of *B. mollis* essential oil was at par withTik Out. Higher concentration of Tik –Out is toxic to poultry, pets and humans. So *B. mollis* essential oil can be recommended as a potent natural mite repellent.

KEYWORDS: *Blumea mollis, Dermanyssus gallinae,* essential oil, mite repellent.

INTRODUCTION

Plants and animals are susceptible to attack by ecto-parasites. *D. gallinae* are avian-specific universal ecto-parasites. *D. gallinae* has already been found to 'switch' more rapidly among avian hosts of different species as compared to other related parasites within the same genus. This tendency for higher switching success reflects their broader host range. *D. gallinae* possess significant threat to egg laying hens in many parts of the world. The infestations of mite populations result in anaemia and even death of hens by exsanguinations.[1] *D. gallinae* may pose a threat to domestic fowl other than poultry.[2] companion birds, such as hobby pigeons and canaries were at risk.

The poultry red mite has been implicated as a potential vector of several pathogens[3] including avian spirochetes, chicken pox virus and eastern equine encephalomyelitis. Control of red mite populations has been done principally by the use of various insecticides like pyrethroid, organo-phosphorus and carbamate-based acaricides.[4] Continued use of these products may result in mite resistance, chemical residues in food and undesirable environmental effects. Therefore it is the need of the hour to find alternative approaches for controlling *D. gallinae*. Plant products can be an alternative source for mite control as they have a rich source of bioactive compounds.[5] Regarding the control of *D. gallinae*, little information was available. Essential oils such as bay, cade, cinnamon, clove bud and thyme oils were reported to possess significant acaricidal activity against mite species.[6] In this juncture, the aim of present study was to ascertain poultry mite repellnt potentiality of *B. mollis* against *D. gallinae* with focus on their exposure time.

MATERIALS AND METHODS

Plant material

The plant material selected for the present study was *Blumea mollis* (D. Don) Merr. an aromatic herb of Asteraceae, growing up to 80 cm tall. Leaves are obovate, 2.5 to 7 cm long and 1- 3.5 cm broad. Rose to pink flowers is borne in dense flat topped clusters. Flower heads are bell shaped. Florets are bisexual. The plants are collected from Varkala village of Thiruvananthapuram District, Kerala.

Dermanyssus gallinae

Dermanyssus gallinae, known as poultry mite were used to analyse the mite repellent property of *Blumea* essential oil. Adult mite measures 0.7 –1.0 mm long; idiosoma oval, colourless to bright red or grey-black. They were

generally white or greyish in colour, becoming darker or redder when engorged with blood.

Extraction of essential oil

The fresh plant material including aerial part, tender stem and leaves of *B. mollis* were chopped into small pieces. 500 g of fresh plant material was subjected to hydrodistillation using clevenger type apparatus. 3L of water was added to the material. The mixture was heated on a heating mantle. The distillation was continued for 3 h. The essential oil obtained was collected and stored at 4^0C in sealed vials until for further analysis. The percentage of yield was calculated using the equation $EO=M/B_mX100$, where M- Mass of extracted oil and B_m- Initial plant biomass.

Analysis of mite repellent potentiality

Mite repellent property of *Blumea* essential oil was studied against *Dermanyssus gallinae.* For the study, mites were collected from bird's skin and surface of nest by wiping the area using tissue paper, once in every day for a week. The number of collected mites was noted every day and they were pre-treated with different concentrations (0.1, 0.2, 0.3, 0.4 and 0.5%) of essential oil in DMSO, once in a day for a week, using a hand sprayer. The number of dead mites were noted per day. The results were compared with Tik-Out, a commercial mite repellent and DMSO, as the negative control. All the experiments were conducted in triplicate.

Statistical analysis

All the experiments were conducted in triplicate. Data were presented as mean ±SD. Significance was noted as $p< 0.05$.

RESULTS AND DISCUSSION

Physical Properties and Yield of Essential oil

The amount of essential oil yielded from *Blumea mollis* was 100µl/100g. It is yellow in colour, transparent and clear with characteristic medicinal aroma. The result was comparable with the yield of *Blumea balsmifera* (0.4 -0.6 ml/100g).[7] Essential oil yields from leaves of *Blepharocalyx salicifolius* and *Myracrodruon urundeuva*[8] were also at par with *B. mollis. Artemisia pallens* also showed an yield of 0.33%.[9] The results substantiate that *B. mollis*is a potent source of essential oil.

Mite repellent potentiality

B. mollis essential oil showed significant mite repellent potentiality against poultry mite-*D. gallinae*. In order to study the mite repellent or killing property, *B. mollis* essential oil was dissolved in DMSO and was sprayed at different concentrations (0.1, 0.2, 0.3, 0.4 and 0.5%), once in a day for a week on collected *D. gallinae*. A commercial mite repellent Tik-out was used as standard. The concentration of tik-out was 0.01%. When compared to Tik-out *B. mollis* essential oil showed comparatively less mite repellent potentiality (Table 1). Meanwhile, increase in the concentration of essential oil showed increased rate of mortality. DMSO has no mite killing potentiality, thus proved its non toxic nature.

Table 1: Mite repellent potentiality of *B. Mollis* essential oil against *D. gallinae*

Days	Total no. of mites collected (from 3 birds)	No. of dead mites after treatment						
		B. mollis essential oil (%)					Tik–out (0.01%)	DMSO
		0.1	0.2	0.3	0.4	0.5		
Day 1	127	109±4	113±3	116±2	119±3	120±3	122±4	5±1
Day 2	91	78±2	80±4	83±2	86±2	88±2	89±2	4±3
Day 3	76	62±3	67±3	70±2	72±1	74±1	73±3	6±2
Day 4	48	37±2	40±2	41±1	42±2	43±3	44±2	4±2
Day 5	25	13±2	17±3	19±1	20±1	21±1	21±1	3±2
Day 6	17	8±2	10±2	11±2	13±1	14±2	15±2	2±1
Day 7	9	2±1	4±1	5±2	6±1	7±2	7±1	2±1

P<0.05

Insects vary enormously in their responses to secondary plants products and it was well known that the sensitivity of different insect species could be quite different for the same substance. Studies proved the toxicity of several essential oils at significant level on different insect populations. Oil from *Cymbopogon nardus* (Graminae) effectively killed *A. obtectus* in a short span of time[10] but it was marginal against *Sitotroga cereallela* (Lepidoptera: Gelichiidae).[11]

Some essential oils repelled the grain weevil *S. granarius* and inhibited its feeding.[12] *Absinthium* (Asteraceae) essential oils exerted both toxic and repulsive effects on pest *S. granaries*.[13] *Ocimum* volatile oils strongly repelled mosquitoes and *O. basilicum* exerted a larvicidal activity evaluated at EC50<81 ppm.[14] Essential oils extracted from common Greek aromatic plants, especially *Satureja, Origanum* and *Mentha* (Lamiaceae), prevented egg hatching and provoked prohibition or malformation of the puparium of the flies *Drosophila auraria*.[15] The inhibition of reproduction of *A. obtectus* by essential oils belonging to Labiatae, Umbelliferae, Lauraceae, Myristicaceae, Graminae, Rutacae, Myrtacae families was also documented.

Plant preparations from thyme and garlic have been shown to be effective acaricides against the poultry red mite, *Dermanyssus gallinae*. Thyme essential oil has a long time effect in compare to garlic preparation. Thyme essential oil also displayed a favorable rate of red mite knock-down in comparison to the other alternative control methods.[16] Studies demonstrated that when mites were exposed to vapor phase of the essential oil without contact itself, showed high mortality in closed fields than in farms open to the environment and suggest that all three essential oils were toxic to *D. gallinae*via fumigant action.[17]

GC–mass spectroscopy (GC–MS) of leaf essential oil from *B. Mollis* was reported by Senthilkumar et al.,[18] and revealed 39 compounds. The major compounds identified were linalool (19.43%), γ-elemene (12.19%), copaene (10.93%), estragole (10.81%), Allo-ocimene (10.03%), γ-terpinene (8.28%) and allo-aromadendrene (7.44%). Linalool was a natural plant-product, which has proven antimicrobial and insect-repellant properties, indicate it might be useful for the control of entero-pathogens or insect pests in poultry farms. The anti bacterial activity of linalool-rich essential oils from *Ocimum basilicum* and *Coriandrum sativum* varieties. Copaene was economically significant as it strongly attract agricultural pests, *Ceratitis capitata*.[19]

Chemical compositions of essential oils effect on their acaricidal activity. Essential oils which were composed of the fewer number of chemical components show the least lethal to *D. gallinae*. i.e.,complexity of an essential oil's chemical constituents plays an important role in dictating thetoxicity of that oil to mite.[19] Studies demonstrates when *D. Gallinae* were exposed to vapor phase of the essential oil, the mortality rate was consistently higher in the closed fields than in open farms. It suggests that essential oils were toxic to mitesby their fumigant action.[19] It can be assumed that the route of action for the oils was largely in the vapour phase via the respiratory system of mites, although the exact mode of action is not properly demonstrated.[19]

Nowadays Tik-out was not recommended to poultries due to their harmful effects. Its major component was cypermethrin (a pyrethroid compound). As a general rule, dogs**,** livestock and poultry tolerate cypermethrin, since toxicity was about 1000x higher to insects and other arthropods than to mammals. But in case of sustained skin or inhalation exposure, or after direct contact with open wounds toxicity to mammals or animals can be higher. In this context *B. mollis* essential oil can be recommended as a potent natural mite repellent.

CONCLUSION

Continued use of chemical mite repellents results in mite resistance and possibility of contamination in the food with undesirable environmental effects. *B. mollis* essential oil is rich in bioactive compounds. From the results of present study it can be concluded that the essential oil of *B. mollis* showed a concentration dependant mite repellent potentiality. This was significant when compared to the standard. Therefore, it is recommendable to use the essential oil of *B. mollis* as a natural mite repellent instead of chemical drugs. Future studies are warranted to trace the mode of action of *Blumea* essential oil against the pest.

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