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Larvicidal Activity of Onion (*Allium cepa*) Peel Extracts Against *Anopheles stephensi*

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Abstract: Mosquitoes are vector for many diseases, killing thousands of people all over the world every year. This requires new approaches to be implemented to regulate and prevent mosquito-borne diseases and to improve public health. The use of biopesticides has increased due to their excellent action against target organisms and environmental safety. The aim of this study was to assess the killing ability of plant derived extracts (*Allium cepa* peel extracts) against the mosquito larvae, *Anopheles stephensi*. The extract of *Allium cepa* peel shows the presence of phytochemicals such as saponins, flavonoids, alkaloids, cardiac glycosides, fatty acids and steroids. 4th instar larvae of *Anopheles stephensi* were exposed to aqueous, chloroform and methanol extracts of onion peel at different concentrations for 24 h. The 24 h LC₅₀ values for aqueous, chloroform and methanol extracts of onion peels for 4th instar larvae of *Anopheles stephensi* were 52.08, 61.59 and 48.23, respectively. It is inferred that methanol extract of onion peel is more effective than the other extracts.

Keywords: *Allium cepa*, Mosquito, Larvicidal activity, *Anopheles stephensi*, Phytochemical, LC₅₀

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Introduction

Anopheles stephensi mosquitoes are epidemiologically related arbovirus vectors in public health situations. The use of natural plant products is preferred among the alternatives to synthetic pesticides for controlling mosquitoes (de Souza Barboza *et al.*, 2015; Giraldo and Guerreo, 2018; Sathiyathan and Umarajan, 2019; Rodrigues *et al.*, 2020). New materials need to be developed in an environmentally safe manner to control mosquitoes. Biologically active chemical molecules developed by a plant could act as growth inhibitors, detoxifiers and inhibitor of

ovulation (Heywood and Zohary, 1995; Thomas and Sadras, 2001; Hemalatha *et al.*, 2015; Penta *et al.*, 2018; Suganthi and Malarvizhi, 2020). Therefore, the extract of raw plants for controlling pests and vectors of infectious diseases has been demonstrated in natural and biological form. This study includes the findings of the larvicidal potential of onion peel extract against larvae of *A. stephensi*.

Materials and Methods

Disease-free peels of the *Allium cepa* were

collected from in and around Chennai, Tamilnadu, India. The plant *Allium cepa* was Identified by Prof. P. Jayaraman, Plant Anatomy Research Center, West Tambaram, Chennai, India.

4th instar larvae of *A. stephensi* were procured from the (ERI), Loyola College, Chennai. The larvae were kept in insectariums at 25-29 C Larval susceptibility test was carried out as described by Singh and Bansal (2003). The aqueous, chloroform and methanol extracts of *Allium cepa* peels were prepared. 4th instar larvae of *A. stephensi* were exposed to various concentrations (20, 40, 60, 80 and 100 ppm) of these extracts separately for 24 h. Individuals of 20 larvae have been kept in glass beakers containing 200 ml of extract solution. Control studies without extracts have been conducted simultaneously. The larvae from each extract were then removed after 24 h and the number of dead larvae was recorded. Five replicates of each experiment were run. The mortality was recorded after 24 h (average of 5 replicates) and calculated using Abbott's formula (Diao, 2007). Probit analysis was used for calculating LC₅₀, LC₉₀ and upper and lower confidence limits (Shaaan *et al.*, 2005; Sharma *et al.*, 2009).

Results and Discussion

The results showed that the *Allium cepa* peel extracts contain several phytochemicals such as alkaloids, steroids, cardiac glycosides, flavonoids etc. Methanol extract of *Allium cepa* peel extract showed maximum number of phytochemicals when compared to other extracts (Table 1).

Various concentrations of *A. cepa* peel extracts (20, 40, 60, 80 and 100 ppm) were subjected to fourth instar larvae of *A. Stephensi*. LC₅₀ and LC₉₀, along with upper and lower confidence limits are shown in Table 2. The 4th instar larvae of *A. stephensi* were highly susceptible to *A. cepa* peel extracts. Mortality of the larvae increased with increasing concentration of peel extracts of *A. cepa*. The 24 h LC₅₀ values for aqueous, chloroform and methanol extracts of onion peels for 4th instar

larvae of *Anopheles stephensi* were recorded as 52.08, 61.59 and 48.23 ppm, respectively. The 24 h LC₉₀ values for aqueous, chloroform and methanol extracts of onion peels for 4th instar larvae of *Anopheles stephensi* were recorded as 136.09, 179.55 and 119.61 ppm, respectively.

Table 1: Phytochemical analysis of *Allium cepa* peel extracts

S.No.	Phytochemicals	Aqueous	Methanol	Chloroform
1	Flavanoids	+++	+++	+
2	Alkaloids	-	+++	+
3	Tri-Terpenoids	-	-	+
4	Saponins	++	++	+
5	Tannins	-	+++	+
6	Triple Sugar	+	+	-
7	Amino acids	-	-	-
8	Antroquinones	+	+	-
9	Steroids	++	+++	+
10	Proteins	-	-	-
11	Cardiac Glycoside	-	+++	++

Table 2: LC₅₀, LC₉₀ and upper and lower confidence limits for *Allium cepa* peel extracts against 4th instar larvae of *A. stephensi*

Extracts	Conc. (ppm)	24 h % Mortality	LC ₅₀ (LCL-UCL) (ppm)	LC ₉₀ (LCL-UCL) (ppm)	Chi-Sq
Aqueous	20	16	52.082 25.992- 88.248	136.096 82.884- 2882.832	20.708
	40	31			
	60	46			
	80	68			
	100	93			
Chloroform	20	13	61.590 55.754- 68.439	179.553 145.469- 243.593	7.265
	40	25			
	60	43			
	80	61			
	100	79			
Methanol	20	17	48.238 26.370- 72.185	119.618 77.750- 770.869	18.384
	40	32			
	60	53			
	80	74			
	100	95			

Conclusion

It can be concluded that crude extract or separated bioactive components from *A. cepa* peel

extracts can be used in dormant water sources identified to be breeding grounds for mosquitoes. The peel extracts of *A. cepa* exhibited significant activity in the control of mosquitoes and their conventional use is very easy.

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