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Study of Thymyl Ethers as a Plant Growth Regulators

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Abstract: **The seed germination bioassay was carried by using fresh and healthy Triticum *astivum L* seeds of Lokwan variety of wheat. A laboratory experiment to study the effect of different concentrations (1%,** and 2%) . **Assays were conducted in 100 x 15 mm Petri dishes lined with a seat of Whatman no.1 filter paper. Observation on germination and the radical length were recorded. The bioassay was carried out with 5 replicates using complete randomized design. A thymyl ethers have been synthesized from thymol under microwave irradiation technique and these are tested against an activity of Wheat seed as plant growth regulators. In conclusion ether compounds have good effect on germination and seedling growth of *Triticum astivum* L (Trade name Lok-one) than thymol and does not depend on the concentration of compound used.**

Index Terms: **Thymol, Ether, Alkylation, Plant Growth Regulator, Monoterpenoids.**

I. INTRODUCTION

The bioassays of phytotoxicity have received great attention by environmental institutes of the world. Phytotoxicity is described as an intoxication of living plants by substances present in the growth medium. The Plant growth regulators are used in agriculture, horticulture and viticulture. These are important to increase crop yield and fruit quality. Therefore, of much interest. These are synthetic compounds essential in small amounts. They promote, inhibit, or modify a physiological process in plants. Similar to the natural phytohormones, many synthetic compounds such as carboxylic acids, esters and sesquiterpenes lactones shows plant growth regulating activity (Picman A. K,1986). Some sesquiterpenes lactones present in certain plants have been reported to be responsible for the allelopathic properties by affecting the germination and growth of other species (Fraga B.M., 1991; Kumbhar P. P, et al.,1999). The potential allelopathic activity of several natural and synthetic sesquiterpenes lactones has been investigated and the presence of α-methylene –β-butyrolactones shows very good biological activity. The presence of other reactive centre such as α, β-unsaturated ketones, chlorohydrin, epoxide, hemiacetal and the molecular arrangement is important for biological activity presented by these lactones (Fischer N. H., et al.,1991)**.** From these observations ether shows plant growth regulatory activity, hence a number of ether derivatives of thymol were prepared and screened for their plant growth regulatory activity (Nikumbh V.P., et al.,2003; Xu H., et al.,2006).

II. REPORTED WORK

Structural modifications of phenolic monoterpenoid obtained by reacting thymol with various substituted α–chloro acetanilides, to improve biological activities. It gives the product with better yield and higher purity under mild reaction conditions by microwave irradiation technique (Pawar N. S., et al.,2010).

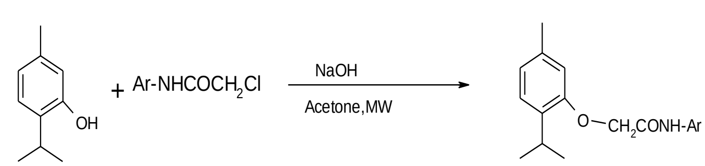
A. Reaction Scheme

STEP-I

$$\text{Ar-NH}_2 + \text{ClCOCH}_2\text{Cl} \xrightarrow[\text{Acetone : DMF}]{K_2CO_3} \text{Ar-NHCOCH}_2\text{Cl}$$

1$_{a\text{-}f}$ **2** **3**$_{a\text{-}f}$

STEP-II



4 **3 a-f** **5 a-f**

Where- Ar,

a = $-C_6H_5$; b = -*p*-CH_3-C_6H_4 ; c = -*m*-NO2-C6H4 ;

d = -*m*-Cl-C6H4 ; e = -*m, p*-Cl-C_6H_3 ; f = -$C_{10}H_7$

Table I: Growth regulating activity of α-chloro acetanilides and ether derivatives of thymol

Compounds	Germination (%) Concentration		Seedling growth			
			Mean Root length(cm) Concentration		Mean shoot length(cm) Concentration	
	1%	2%	1%	2%	1%	2%
Aniline	06.66	----	----	----	----	----
Thymol	----	----	----	----	----	----
3a	----	----	----	----	----	----
3b	16.66	23.33	0.34	1.30	0.26	0.35
3c	----	----	----	----	----	----
3d	03.33	----	0.20	----	0.4	----
3e	20.00	40.00	3.72	1.35	1.48	0.63
3f	26.66	33.33	1.10	2.35	0.78	2.48
5a	50.00	96.66	0.60	1.40	0.1	----
5b	96.66	50.00	1.06	0.38	0.46	----
5c	00.00	06.66	----	----	----	----
5d	60.00	56.66	0.52	0.51	-0.14	----
5e	16.66	----	0.44	----	0.10	----
5f	90.00	06.66	1.53	0.10	0.15	----
Control	93.33	63.33	2.14	0.40	0.63	----

III. MATERIAL METHODS

A. Germination of wheat seed

Static-type germinability assays with wheat were conducted in a germination chamber for three days according to the rules for seed testing published by the Association of Official Seed Analysts (1981). Uniform healthy grains of wheat (Triticum aestivum L.) were obtained from National Seed Corporation Ltd., New Delhi, India. These seeds were surface sterilized with 0.1% aqueous solution of mercuric chloride, followed with repeated washings by using sterilized double distilled water. The 1% and 2% solution of all the compounds were prepared in acetone.

The bioassay was carried out by Literature method (Green J. F., et al.,1978) using healthy *Triticum astivum (*Wheat seed*)* of Lok-one variety. The 1% and 2% solution of all the compounds were prepared in acetone. Assays were conducted in 100 x 15 mm Petri dishes lined with a seat of Whatman no.1 filter paper. To each dish, 2 ml solution was added and the solvent was evaporated before addition of 2 ml of water followed by 30 seeds of Wheat were allowed to germinate at 25^0C under artificial fluorescent light in an incubator for three days. Observation on germination and the radical length were recorded. Seeds were considered to be germinated, if at least one mm of radical protruded. The experiment was carried out under similar conditions using acetone only. The bioassay was carried out with 5 replicates using complete randomized design. The Vigor index and percent phytotoxicity (Abdul-Badi and Anderson J. D,1973; Bhatt B. P., et al.,1993; Igboanugo A. B.et al.,1986; Pawar N. S.,2017) having the formula as below:

1) Vigour index (VI) = Germination percentage X Total length of seedlings

2) % **Phytotoxicity =**

$$\frac{\textbf{Radical length in control} - \textbf{Radical length in test}}{\textbf{Radical length in control}} \text{x}100$$

Bioassay is an important in evaluation of bioactivity of the compounds and helpful to found structure-activity relationships (SAR). The present study aimed to synthesize compounds having substituted acetanilides moiety, further coupled with thymol and growth regulating activity of all synthesized compound against *Triticum astivum*, (Trade Name: Lok-one) are studied.

B. Statistical Analysis

Each result shown in a table was the mean of at least five replicated treatments.

III. RESULT AND DISCUSSION

Phytotoxicity inhibition in germination of *Triticum astivum* (Wheat) was observed at all test concentrations. The minimum germination of *Triticum astivum* at a concentration of 1% was recorded with **5c** as compared to control (acetone

93.33%). The maximum germination of 96.66 % at 1 % concentration was observed with **5b** i.e ether derivatives of thymol (**Table 1**). While compounds thymol, **3a** and **3c** do not show germination at 1 % concentration. The minimum germination of *Triticum* astivum at a concentration of 2% was recorded with **5c** and **5f** as compared to control (acetone 63.33 %) whereas maximum germination of **96.66 %** at 2 % concentration was observed with **5a** i. e. ether derivatives of thymol. The compound aniline, thymol, **3a, 3c, 3d, 5e** do not show germination.

The compound **3d** shows significant decrease (**0.20**) in growth regulating activity at 1% concentration and compound **5f** shows significant decrease 0.1 % in growth regulating activity at 2% concentration.

A decrease in shoot length of the treated seedlings than control was observed with all the tested compounds (**Table 1**). However, no fixed pattern was found. In case of ether derivatives of thymol **5a-f** all compounds except **5c** shows germination or seedling growth.

Table II: Vigour index and phytotoxicity

Compounds	Vigour Index		Phytotoxicity	
	Concentration		Concentration	
	1%	2%	1%	2%
Aniline	3.66	----	93.24	100.00
Thymol	----	----	----	-----
3a	----	----	100.00	100.00
3b	9.99	38.49	90.81	64.86
3c	----	----	100.00	100.00
3d	1.99	----	94.59	100.00
3e	104.4	79.21	----	----
3f	50.12	160.98	70.27	36.49
5a	30.5	135.32	0.779	-1.97
5b	146.9	19.0	0.461	0.19
5c	----	0.99	-----	-0.085
5d	39.6	28.89	-0.761	----
5e	8.99	----	0.805	0.88
5f	151.2	0.66	0.393	----
Control	258.5	29.76	----	----

The calculated vigour index (**Table 2**) shows that there was inhibition of growth of wheat seedling at 1% and 2% concentration. The minimum inhibition of seedling vigour was recorded with compound **3d** (1.99) at concentration 1% and **5f** (0.66) at 2 % concentration. The maximum inhibition of seedling vigour is shown by compound **3f** (160.98) at 2% concentration.

The highest phytotoxicity was found to be 100 % in case of compound **3a** and **3c,** while minimum phytoxicity was found in **5d** at 1% concentration. The compound **aniline, 3a, 3c** and **3d** shows the highest phytotoxicity (100%) while minimum phytotoxicity was found to be in **5a** and **5c** at 2 % concentration. The compound thymol, **3e** and **5c** do not show phytoxicity at 1 % concentration. While the compounds thymol, **3e, 5d** and **5f** does not shows phytoxicity at 2 % concentration.

Thus, it can be concluded that the ether compounds have good effect on germination and seedling growth of *Triticum astivum* (Trade name Lok-one) than thymol and does not depend on the concentration of compound used.

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