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Chemical examination and insecticidal properties of *Tagetes erecta* and *Tagetes patula*

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The chemical composition and insecticidal properties of *T. erecta* and *T. patula* (Family: Asteraceae) were carried out in the methanol, hexane and acetonitrile extracts of flower, foliage and root. The major compounds are β – caryophyllene, piperitenone, tetracontane, C_{33} botryococcane and decane. In which different concentration of volatile oil exhibit more insecticidal properties. In the present investigation the hexane extract of flowers of *Tagetes erecta* showed better anti insecticidal property against aphids and *Spodoptera frugiperda*.

Key words : *T. erecta* and *T. patula*, Volatile, Insecticidal, *Alphids, Spodoptera frugiperda*

INTRODUCTION

Natural insecticides were seldom used for the control of insects, after the emergence of the U.S insecticide industry in the 1930's. The notion of insecticidal compounds in marigold is not new. Numerous classes of compounds in marigolds are known that produce various biological responses in organisms but only a few are known to be insecticidal.

The plant *T. erecta* and *T. patula* known as (French marigold and Aztec marigold) belongs to the family Asteraceae and is widely distributed in the temperate forests and mountain regions of most of the countries in the world as a weed. It has been reported from South Africa, Australia, Nigeria, India (Gardener *et al*., 1991; Craveiro *et al.*, 1988; Baser and Mayler, 1996; Changonda and Makanda, 1999; Rao *et al.*, 1999). The presence of ocimene, dihydrotagetone, tagetones and ocimenones in the oil are a good source of a base materials for the synthesis of aromatic chemicals. Insecticidal activities of phototoxins are present in the Asteraceae species (Rawls, 1986). A phototoxin extracted from marigold alpha terthienyl, was shown to be extremely insecticidal against mosquitoes, but did not affect nontarget organisms like the ostracod, caddisfly and Physa spp. The adsorption and absorption of volatiles on a coated fused – silica fibre, followed by thermal desorption in the injection port of a gas chromatography. In the present study, chemical composition erpecially volatile oils are examined and their insecticidal properties are noted at different concentrations.

MATERIALS AND METHODS

The flower, foliage and root of *T. erecta* and *T. patula* L. were collected from botanical garden of Tamil Nadu Agricultural University, Coimbatore (T.N.) during December 18th to March 21st and they were allowed to shade dried and powdered. Collected specimens were carefully examined and identified with the help of Flora of presidency of madras (Gamble, 1935) and further authentication was done by comparing with the existing herbarium of the botanical survey of India, Southern Circle, Coimbatore. Insects were collected from Bio assay laboratory, Tamil Nadu Agriculture University, Coimbatore (T.N.).

Dried and powdered flowers, leaf and root (100 g) of *T. erecta* and *T. patula* were extracted separately with hexane (non polar solvent), methanol (medium solvent) and acetonitrile (polar solvent) using soxhlet extractor. Extracts thus, obtained will be concentrated on rota vapour and separated in glass vials and stored at 4^0C in refrigerator for further use. GC-MS (Gas Chromatography – Mass Spectrometry) was used for analytical method. It separates a minute unknown compounds and this combination produces 3 dimension data that provides quantitative and qualitative analysis.

The components of the oils were identified by comparison of their Mass spectra with those of a computer library or authentic compounds or data published in the literature (Davies, 1990; Shibamota, 1987).The insecticidal activity of Aphids and *Spodoptera frugiperda* were studied. Before allowing the insects, the leaves are treated with volatiles in different concentrations. The insects were carefully transferred to the different concentrations of treated volatile leaves placed in a Petridishes. The plates were undisturbed for 24 hours. Each test was replicated 3 times. The mortality percentage was obtained by using

ABOTT's formula which is mentioned below (Swarrop, 1968; Busvine, 1971).

$$\textbf{\% Mortality} = \frac{\textbf{Number of dead insects}}{\textbf{Total number of insects treated}} \times 100$$

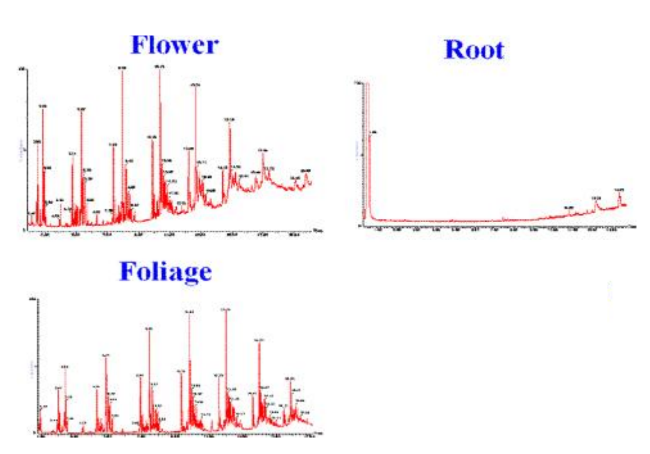
Results and Discussion

Results of present investigation clearly indicated that all the three dilutions of the extracts having insecticidal properties against the insects. In which hexane extract of flower of *T. erecta* showed major peaks in the GC profile which is indicated in Table 1 and Chromatogram1.

Table 1: Percentage composition of the volatile oil of *T. erecta* in hexane extract

Sr. No	Retention time	Compound name	Flower (%)	Foliage (%)	Root (%)	Method of identification
1.	3.21	Octadecane	2.6	2.4	0.6	MS, RT
2.	3.26	Decane	12.3	4.3	2.0	MS, RT
3.	4.30	1 H – indene, 1 – methylene	0.6	t	t	MS, RT
4.	5.11	Pentadecane	2.6	0.8	2.3	MS, RT
5.	5.67	Eicosane	3.1	0.8	0.5	MS, RT
6.	5.79	Decane, 2- methyl	7.9	2.1	7.0	MS, RT
7.	5.90	Nonadecane	1.	0.1	t	MS, RT
8.	6.10	Car – 3 – EN – 2 – one	0.	t	t	MS, RT
9.	6.65	Undecane	0.3	t	t	MS, RT
10.	7.73	Docosane	8.7	0.4	0.6	MS, RT
11.	8.28	Henicosane	5.9	4	2.0	MS, RT
12.	8.40	6- Tetradecane sulphuric Acids, Butylester	2.	t	t	MS, RT
13.	8.52	Triacontane	1.7	0.3	t	MS, RT
14.	8.78	Dodecane, 3 – methyl	0.5	t	t	MS, RT
15	10.23	Hexatriacontane	2.9	0.3	t	MS, RT
16	10.73	Tetrapentacosane	6.0	2.8	t	MS, RT
17.	10.84	Tetrapentacontane	1.7	t	t	MS, RT
18.	10.95	Dotriacontane	2.0	t	t	MS, RT
19.	11.05	Octadecanol	0.8	t	t	MS, RT
20.	11.20	Tetracosane, 2,6,10,15,19,23 – Hexamethyl	0.7	0.1	t	MS, RT
21	12.56	Squalene	2.7	0.2	t	MS, RT
22.	13.01	Tetracontane	15.6	t	t	MS, RT
23.	14.75	Methyl (3s, 4s) – 2,3,4 5 – Tetra hydro – 4 methyl	1.8	t	t	MS, RT
24.	15.18	Octadecane, 2, 6, 10, 18 – Tetramethyl	3.7	4.1	t	MS, RT
25.	17.34	Heneicosane	3.7	2.6	t	MS, RT
26.	17.44	C33 Botryococcane	13.8	4.8	t	MS, RT
27.	17.47	I – Dodecanol	t	t	t	MS, RT
28.	18.70	Decane, 2 – methyl	t	8.0	t	MS, RT
29.	18.79	Hentriacontane	t	0.3	t	MS, RT
30.	20.62	Citronellyl propionate	t	0.9	t	MS, RT
31.	20.75	Cyclotrisilone	2.3	t	0.4	MS, RT
32.	20.92	Hexadecanoic acid	t	t	2.6	MS, RT
33.	22.23	Piperitenone	16.2	8.3	t	MS, RT
34.	22.30	2, 2' – 5', 2' – Terthiophene	t	t	11.0	MS, RT
35.	22.59	6-bromo-5 – oxo -3-methylherxan-1, 3- diol	t	t	6.	MS, RT
36.	23.47	2, 2, 6, 6- Tetramethyl – piperidine	t	0.6	t	MS, RT
37.	23.86	Decane 2 – methyl	12.2	0.5	t	MS, RT
38.	24.90	Napthalene	t	20.6	15.3	MS, RT
39.	25.08	β – caryophyllene	32.3	20.6	15.3	MS, RT
40.	25.36	Nonadecane, 2, 6, 10, 14, 18 – pentamethyl	t	0.1	t	MS, RT

MS- Mass spectrometry; RT- Retention time; t – less than 0.05%



Chromatogram 1 : GC Profiles of *T. erecta* samples in Hexane extract

The major compounds viewed in GC profile were β – caryophyllene (Flower = 32.3; Foliage = 20.6; Root = 15.3), Piperitenone (Flower = 16.2; Foliage = 8.3; Root = t), Tetracontane (Flower = 15.6; Foliage = t; Root = t), C33 Botryococcane (Flower = 13.8; Foliage = 4.8; Root = t) and Decane (Flower = 12.3; Foliage = 4.3; Root = 2.0). As a result of chemical investigation chromatogram 1 shows that high peak occurred in hexane extract of flower of *T. erecta* and examined 40 new compounds. In the insecticidal bioassays the best result occurred in different concentration of *T. erecta* flower oil against *Acyrthosiphon gosypii* and *Spodoptera frugiperda* (Table 2 and 3). Table 2 shows that high mortality occurred in 1000 ppm (T_3) as compared to that of control. Table 3 shows that high mortality occurred in 5000 ppm (T_3) as compared to that of control. As a result *T. erecta* was determined to be the most active than *T. patula*.

Table 2 : Percentage mortality of *A.gosypii* at different concentrations of *T. erecta* flower oil

Sr. No.	Treatments	No. of larvae	Mortality(%)
1.	Hexane	5	0
2.	1000 ppm	5	70
3.	500 ppm	5	60
4.	100 ppm	5	50

Table 3 : Percentage mortality of *spodoptera* at different concentrations of *T. erecta* flower oil

Sr. No.	Treatments	No. of larvae	Mortality(%)
1.	Hexane	5	0
2.	5000 ppm	5	70
3.	2500 ppm	5	50
4.	1000 ppm	5	40
5.	500 ppm	5	20
6.	100 ppm	5	10

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