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Comparative study for chemical reaction of cultivated rose (*Rosa hybrida*) and Taif's rose (*Rosa damascena* Miller var. *trigintipetala*) in relation to incidental infestation with two- spotted spider mite *Tetranychus urticae.*

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ABSTRACT

The present study was proposed to stepwise investigation for differences between *Rosa damascena* Miller var. *trigintipetala* and *Rosa hybrida* concerning volatiles emitted from leaves and synthesizing of secondary metabolites such as phenolic compounds induced by herbivore mite *Tetranychus urticae* Koch, The cross talk between these defense compounds and phytoseiid mite natural enemy. Also biology of *T. urticae* on both rose cultivars, considering unique surplus rose oils of *R. damascene* over these experiments. Results obtained showed that female egg production of *T. urticae* on *R. damascene* approached 1/3 that for *R. hybrida* cultivar. Although the prey consumption of *A. californicus* was almost similar on both cultivars in the laboratory. It was noticed that induced defense constituents such as α-pinene, myrecene, farncen eucalyptol and caryophelene were more abundant in infested leaves of *R. damscena* than check. On the other hand Eucalyptol as biopesticide was missing in *R. hybrida* which in turn were distinctive in containing methyl salicylic acid working as an attractant for predatory mite. However the picture of phenolic acid quantities resulted from Taif's rose are not identical with wT cv. That is a regular induction to synthesis higher quantity of phenolics comparing to check. Some of these compounds were traces in check but duplicated several times due to *T. urticae* infestation such as Luteolin, Vanillic, Caffeic, Cholorgenic acids. Also other phenolic acids as Gallic, catshinec acid Ferulic acids were duplicated and more which in turn reflect the induced resistance or the antibiotic effect of Taif's rose secondary metabolites.

Keywords; rose oils, Taif's rose, cultivated rose, volatile oil, phenolic compounds.

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INTRODUCTION

Taif's Rose (*Rosa damascina var. trigintipetala*) is an important and economical aromatic plant which cultivated for volatile oil. There are a lot of pharmacological properties of rose including antioxidant, hypnotic, anti-bacterial, anti-diabetic, and relaxant effect on tracheal chains have (Boskabady et al., 2011). Also, it used as floriculture plants in gardens, parks, and houses and they are principally cultivated for using in perfume, food industry and medicine (Jabbarzadeh and Khosh-Khui, 2005). Rose water was scattered at weddings to ensure a happy marriage and are symbol of love and purity and are also used to aid meditation and prayer. Because of the low oil content in *R. damascena* and the lack of natural and synthetic substitutes, essential rose oil of rose consider one of the most expensive ones in the world markets (Baydar and Baydar, 2005).

It has been suggested that the *Taif's rose* was brought to Taif from Balkans by Turks, who occupied this area in the 14th century. However, the rose Kazanlik, whose Turkish name means "suitable for the [distiller's] kettle," has its origins in the Persian Rose plantations around Shiraz and Kashan. The legends say that this rose actually originates from India. In the West it is the Damask Rose that is known for its deep and intense fragrance, while in the Arabian World it is the Taif Rose that is famous for the same properties. *Taif's rose* flowers, whose fragrance is even more intense than the fragrance of the Damask Rose, are harvested in April, in the early morning hours, because the buds bloom at dawn. It is necessary to pick them before the Sun and the heat of the day destroy the essential oils needed for the production of rose water. To the present, Taif is known for something other than that. It is known for the famous *Wardh Taifi*, the Rose of Taif. The suburbs of Taif and its valleys Hada, Al Shafa, al Ghadeerayn and Wadi Mahram, are known for cultivation of this rose, which creates more income than the cultivation of vegetables or crops. Taif is placed 2000 meters above sea level and due to its climate conditions (cooler than the climate in Jeddah and Mecca), qualitative irrigation systems, and fertile land, it is a great area for the cultivation of roses. In the time of the Ottoman Empire, this region was named the Arabian Rose. Saudi Arabian Kingdom particularly, Taif Governorate is known for the, pharmaceutical production of a high quality rose essential oil, from *Rosa damascene* as well as Bulgaria, Turkey, France and India are the largest producers of rose essential oil.

In Egypt Also, the area under plastic house conditions devoted for cut flowers are incredibly increasing in particular in Nile delta. It reached about hundred thousand square meters. Most of the production is for export UPEHC (2012). The two spotted spider mite are the key pest of these farms beside mildew diseases. Qualities of cut flowers depend on control practices of these pests. The frequent applications of pesticide against pests accelerate build up of resistances which represent the main constraint in the production process. Therefore introduction of predatory mite in cut flower plastic tunnels are growing in Egypt to check out spider mite. However host plant interaction with either pest i.e. mildew fungi or spider mite in terms of plant signal and their interaction with predatory mite are questionable as seen in practices and in literature.

The two spotted spider mite *Tetranychus urticae* koch is the main acarine pest endangering vegetables, in particular these produced in plastic houses such as cucumber, tomatoes, sweet pepper, egg plant etc….likewise the export quality of plastic tunnel roses, chrysanthemum Gerbera based on their *T. urticae* infestation grade (Helle and Sabelis, 1985). The main disease attacking the aerial part of plantations under plastic tunnel conditions are mildew diseases based on prevailing relative humidity (50-85%), temperature (15-40˚C) El-laithy (1996).

Field observation of *T. urticae* in roses revealed differences in severity of damage recorded for both rose species. Taif rose with its thick and ligninsed leaves did not show in case of severe infestation the discolored spots of leaves as seen in *R. hybrid.* Besides a stable interaction between prey and predatory mite during summer and early fall that prey density was very low. But, when downy mildew started to flourish on rose leaves it was followed by exterminate of predatory mite *A. californicus*. The ascetic value of both rose types varies considering flowering style and intervals, i.e. sustainable as Egyptian rose cultivars or limited (April-May/year) is the case of Taif rose Such observations besides lacking investigations with downy mildews enhanced the present work to search for the interactive relationship between host plant both of prey and predatory mites. Role of volatile blend, such as methyl salicylate, terpenes, oximes, and nitriles in this context (Krips et al., 2001; De Boer et al., 2004 & 2008; Rohwer and Erwin, 2008). It is well established that plants infested with a single herbivore species can attract specific natural enemies through the emission of herbivore-

induced volatiles. However, it is less clear what happens when plants are simultaneously attacked by more than one species belongs to different kingdoms. Therefore, we are willing to study firstly,

1- Identification of essential oils and phenolic compounds from Taif rose comparing to cultivated rose with and without herbivore infestation.
2- Biology of *Tetranychus urticae* on both rose species.

MATERIALS AND METHODS

The present study was conducted to determine the chemical composition (constituents) of *Rosa damascena* Miller var. *trigintipetala* and *R. hybrida* leave extracts. Concerning Taif's rose, the leaves were collected at the end of May, 2014 during the rose cut flowers season, from different local farms (Al-Hada and Al-Shefa), Taif governorate, Saudi Arabia. While, *R. hybrid* were collected from private farms in Elkanater, Qaliopia Governorate, Egypt. One rose cultivar was presented white Teneky (WT) leaves free from infestation were collected separately. Leave sample 0.1 kg of leaves from both rose cultivars were used. Similar samples were collected from these with incidental infestation. Egyptian cultivar was infested with *T.urticae* besides weak downy mildew symptoms while Taif's rose showed spider mite and yellow rust disease. Rose flowers were not used because infestations are concentrated mainly on leaves, but flowers were attacked only latterly in severe leave infestation.

Extraction of essential oils from roses cultivars

The fresh leaves were hydro distilled for 3 h, using a Clevenger-type apparatus, according to the European Pharmacopoeia method (Council of Europe, 2007). The essential oils were stored at -20^{o}C in the dark until analysis by gas chromatography (GC) and gas chromatography-mass spectrometry (GC-MS) (Ghazghazi et al., 2010). The GC-Ms analysis of the essential oil samples was carried out using gas chromatography-mass spectrometry instrument stands at the Laboratory of Medicinal and Aromatic Plants, National Research Centre with the following specifications. Instrument: a TRACE GC Ultra Gas Chromatographs (THERMO Scientific Corp., USA), coupled with: a THERMO mass spectrometer detector (ISQ Single Quadruple Mass Spectrometer). The GCMS system was equipped with a PR5 MS column (30 m x 0.25 mm i.d., 0.25 cm film thickness). Analyses were carried out using helium as carrier gas at a flow rate of 1.0 mL/min at a split ratio of 1:10 and the following temperature program: 40°C for 1 min; rising at 4.0 C/min to 160°C and held for 6 min; rising at 6°C/min to210°C and held for 1 min. The injector and detector were held at 200 and 240°C, respectively. Diluted samples (1:10 hexane, v/v) of 0.2 ml of the mixtures were always injected. Mass spectra were obtained by electron ionization (EI) at 70 eV, using a spectral range of m/z 40-450.Most of the compounds was identified using two different analytical methods: mass spectra (authentic chemicals, Wiley spectral library collection and NSIT library).

Extraction of toxin compounds from Taif's rose and Egyptian cultivars

Preparation of the extracts Traditional Soxhlet extraction was carried out; leaves (3 g) were extracted at room temperature with hexane till complete extraction to remove lipoidal matter, waxes, pigments, sterols and non-phenolic compounds., dichloromethane. Then the plant was extracted with 80% methanol several times (10 ml x 4) till complete extraction. The methanol extract was filtered and concentrated in a rotary evaporator, brought to a fixed volume and used for quantitative evaluation of total phenolic compounds and flavonoids.

Biology of *Tetranychus urticae* on rose species.

A stock culture of the two–spotted spider mite (TSSM) *T. urticae* was maintained in a plastic container 10 x 20 cm. a Piece of sponge covered by cotton was used as substrate over which clean acalifa *Acalifa wilkisiana* Mull. Leaves rested and surrounded by water as barrier to prevent mites from escaping. Culture was renewed whenever it is necessary. Rearing arenas of TSSM. Consists of, 10 x 15 cm rectangular foam box in which a cotton pad was used as a substrata over which disks of rose leaves for rearing was settled. Newly laid eggs of *T. urticae* were transported singly on each leaf disk. Each rose cultivar yellow, white and *R. damascena* (Taif's rose) was represented by 25 replicates. Rearing foam boxes was put in an incubator at 28±2°C and 70 ± 5% RH. Observations were carried out daily for development of eggs until maturity and end of life span.

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Biological studies included post embryonic development of *N. californicus* newly laid egg feeding on *T. urticae* immature stages. The *T. urticae* nymphs were counted and provided from stock culture on excised rose leaves and left to move on the rose leaves discs of the experiment.

Table (1): Essential oil composition of Taif،s rose with and without infestation

Compounds		RT.	KI[b]	Taif rose without infestation	Taif rose infested with *T.urticae*
				Area %	Area %
α- pinene	mt*	5.42	932	2.41	2.74
Camphene	mt	5.91	949	1.76	2.09
β- pinene	mt	6.74	980	2.55	2.37
β-Myrcene	mt	7.00	988	1.88	1.30
β-Cymene	mt	8.35	1027	0.49	0.36
D-Limonene	mt	8.45	1030	1.57	tr
Eucalyptol	mt	8.61	1034	1.56	5.80
γ –terpienen	mt	9.54	1059	0.39	tr
Linalool	mt	11.26	1104	0.68	0.35
Nonanal		11.56	1110	-	0.49
β-Thujone	mt?	11.65	1113	tr	0.38
Camphor	-	13.49	1155	0.7	1.41
Borneol		14.53	1179	0.61	0.47
α-Terpineol	-mt	15.59	1203	0.92	0.87
2-Pentene, 1-ethoxy-4-methyl-,		17.24	1240	-	0.49
L borneol acetate		19.41	1287	0.74	0.63
Anethole	-	19.77	1295	tr	0.82
αTerpinenyl acetate	-	22.21	1350	4.5	3.00
Caryophelene	-	25.31	1419	15.07	10.98
Alloaromanderene		25.61	1427	0.53	tr
α-Bergamotene		25.81	1431	-	0.48
β-Selinene		25.88	1433	0.66	tr
Aromanderene		26.09	1437	4.07	1.92
δ-Guaiene		26.44	1446	0.39	tr
α-Caryophyllene		26.87	1456	6.75	3.67
γ muurolene		27.7	1475	0.5	tr
Germacrene D		27.97	1483	0.42	-
(+)-Ledene		28.35	1491	1.35	2.04
α-Farnesene		28.97	1505	-	11.60
γ-Cadinene		29.37	1514	0.52	1.24
(+)-δ-Cadinene		29.54	1519	1.36	0.76
trans-Z-α-Bisabolene epoxide		31.24	1560	0.58	tr
(±)-trans-Nerolidol		31.40	1564	tr	1.14
trans-Geranylgeraniol		31.79	1573	0.41	1.71
cis-3-Hexenyl benzoate		32.08	1580	-	5.50
Spathulenol		32.13	1581	4.05	-
Caryophelene oxide		32.33	1586	7.55	5.06
Globulol		32.49	1590	0.5	tr
Ledol		32.86	1599	12.33	9.89

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Viridiflorol	33.24	1609	0.42	-
Humuline1,2 epoxide	33.49	1615	2.87	2.10
Cubenol	33.66	1619	-	0.91
Calarene epoxide	34.43	1639	2.17	1.10
Tetracyclo[6.3.2.0(2,5).0(1,8)]tridecan-9-ol, 4,4-dimethyl -	34.61	1643	3.77	1.51
tau.-Cadinol	34.8	1648	-	6.26
Humulane-1,6-dien-3-ol	34.89	1650	1.52	-
trans-Z-α-Bisabolene epoxide	35.34	1662	6.78	4.05
Alloaromadendrene oxide-(2)	35.74	1672	0.49	-
Isoaromadendrene epoxide	35.96	1678	3.72	1.87
Lanceol, cis	37.68	1722	0.41	tr
Longipinocarveol, trans	38.12	1734	-	0.56
Benzyl Benzoate	39.94	1783	-	0.46
Hexahydrofarnesyl acetone	42.13	1843	tr	0.67
Oxygenated compound			57.28	57.5
Non Oxygenated compound			42.67	41.55
Monoterpen			20.76	23.57
Sesquterpen			79.19	75.48
Total identified			99.95	99.05

[b]KI = Kovats indices in reference to n-alkanes (C8–C23) confirmed by comparison on DB-5MS
tr: Compounds less than 0.05
mt. refers to monoterpines

Table 1a. Flavonoids and phenolic isolated from Taif's rose with and without *Tetranychus urticae* infestation.

Compound	Without *T. urticae* ugg^{-1}	With *T. urticae* ugg^{-1}
Gallic	482.0995	901.4314
protochatachuic	351.67	453.4211
Hydroxybenzoic	ND	ND
Catachine	62.60	104.1199
Cholorgenic	ND	ND
Caffeic	ND	13.97422
Syrngic	6.79	18.61539
Vanillic	ND	11.96163
Ferulic	75.21309	285.7815
Sinapic	17.22317	90.65223
Ruten	459.4939	581.6357
Coumarin	12.96129	17.38814
Rosmarinic	235.2365	320.3958
Cinnamic	10.76116	25.95552
Luteolin	ND	ND
Qurecetin	34.18827	44.67576

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Table 2. GC/MS fractionation of volatile oils extracted of *Rosa hybrida* of whit teneky cultivar leaves check plot as area (%).

KI[a]	RT.	Compounds	Area %
1139	6.57	α-Phellandrene	tr
1143	6.65	β-Myrcene	3.27
1168	7.26	Limonene	1.36
1182	7.61	β-Phellandrene	tr
1211	7.51	Sabinene	9.24
1254	9.62	α-Terpinene	1.13
1303	11.11	2-Hexen-1-ol	tr
1366	13.09	p-Mentha-1,3,8-triene	tr
1414	14.58	p-Cymenene	1.29
1509	17.54	1-Methyltridecyl ethoxyacetate	T
1557	19.03	β-Elemene	1.53
1591	20.03	Hexadecane	tr
1651	21.82	l-Gala-l-ido-octose	tr
1690	22.99	Farnesol	tr
1723	23.91	α-Selinene	2.32
1734	24.23	β-esquiphellandrene	3.81
1786	25.71	γ-Elemene	1.08
1811	26.38	Anethole	5.20
1986	31.04	Carotol	tr
2573	40.38	MYRISTCIN	51.62
2995	47.00	Apiol	tr

[a]KI: Kovats retention index on TG-WAX MS column

Table 2a. GC/MS fractionation of volatile oils of *Rosa hybrida* white teneky cultivar leaves in treatment plots attacked by *T. urticae* measured as area %.

KI[a]	RT.	Compounds	Damaged Leaves of *R. hybrida* Cultivars White Tenky *T. urticae*
1211	8.39	2-Hexenal	tr
1304	11.14	3-Hexen-1-ol, acetate, (Z)-	tr
1371	13.23	3-Hexen-1-ol, (Z)-	5.57
1376	13.39	Nonanal	tr
1393	13.94	2-Hexen-1-ol	6.07
1462	16.09	Furfural	tr
1523	17.97	α-Hydroperoxy diethyl ether	25.69
1534	18.33	L-Linalooll	7.91
1558	19.05	caryophyllen	tr
1621	20.96	Neomenthol	1.12
1640	21.51	Phenyl acetaldehyde	tr
1682	22.75	β FENCHYL ALCOHOL	3.04
1698	23.21	(Z.E)- α-Farnesene	tr
1720	23.84	(E,E)- α-Farnesene	tr
1761	24.99	Methyl salicylate	3.09
1780	25.52	4-(2,2-Dimethyl-6-methylenecyclohexyl) butanal	tr
1785	25.68	Nerol	tr
1811	26.39	anethole	tr
1834	27.01	Geraniol	2.85
1889	28.50	Butyl Hydroxy Toluene	23.47
2040	32.01	Hexaethylene glycol	1.36
2488	39.05	Heptaethylene glycol	1.44

[a]KI: Kovats retention index on TG-WAX MS column

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Table 2b. HPLC fractionation of phenolic acids extracted from of *Rosa hybrida* cultivar white teneky of check plot and *T.urticae* infested leaves as mg/100g of leaves.

Compound	*T. urticae*	Control
Catchinic acid	27.256	14.599
Gallic acid	152.869	166.879
Caffiec acid	69.848	76.422
Vanillic acid	51.363	41.616
Coumaric acid	14.464	25.734
Ferulic acid	28.701	34.361
Cinnamic acid	63.466	57.604

Table 3. Biology of *T. urticae* on Taif's rose

Egg	Larvae	pn	dn	Lfe cycle	pop	o.p.p	Post op	Longevity	Life span	Total fecundity
8	4	3	3	18	2	15	7	24	42	44
8	4	3	3	18	2	18	0	20	38	72
8	4	3	3	18	2	24	3	29	47	80
8	4	3	3	18	2	26	1	29	47	75
8	3	3	4	18	2	9	1	12	40	14
8	4	3	3	18	2	14	1	17	35	33
8	4	3	3	18	2	16	2	20	38	49
8	4	3	4	19	2	22	3	27	46	54
8	4	3	3	18	2	21	1	24	42	63
8	4	3	3	18	2	16	2	20	38	48
8	3	3	5	19	1	16	3	20	39	40
8	4	3	3	18	2	12	3	17	35	47
8	4	3	3	18	2	3	2	7	25	16
8	4	3	3	18	2	13	2	17	35	35
7	3	3	4	18	2	12	2	16	34	27
8	4	3	3	18	2	6	2	10	28	22
8	4	3	3	18	2	12	1	15	33	29
8	4	4	4	20	3	9	1	13	33	17
8	4	3	4	19	2	24	3	29	48	48
7	4	3	4	19	1	14	1	16	35	45
Mean										
7.9	3.85	3.05	3.4	18.3	1.95	15.1	2.05	19.1	37.9	42.9
STDV										
0.308	0.366	0.224	0.598	0.571	0.394	6.112	1.468	6.381	6.210	19.431
S.error										
4.0±0.0	1.27±0.1	0.91±0.05	0.82±0.5	9.27±0.12	0.82±o.06	12.82±0.3	2.64±0.24	16.27±.35	25.5±0.35	141.1±11.7

Table 3a. Biology of *T.urticae* on *R.hybrida* Whit Teneky cultivar

Life cycle	Pre-oviposation	Oviposation	Post-oviposation	Longevity	Life span	Total egg oviposation	Total egg/Day
9	1.0	16	2	19.0	28.0	220	13.75
10	1.0	13	2	16.0	26.0	85	6.54
8.5	1.0	11	4	16.0	24.5	143	13.00
9	1.0	13	4	18.0	27.0	133	10.23
9	0.5	13	1	14.5	23.5	248	19.08
9	1.0	13	2	16.0	25.0	140	10.77

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9	1.0	13	3	17.0	26.0	101	7.78
10	0.5	13	4	17.5	27.5	117	9.00
9	1.0	13	2	16.0	25.0	131	10.08
9.5	0.5	12	2	14.5	24.0	109	9.08
10	0.5	11	3	14.5	24.5	125	11.36
				Mean			
9.27	0.82	12.82	2.64	16.27	25.54	141.10	10.97
				STDV			
0.52	0.252	1.33	1.03	1.49	1.48	49.45	3.41

Statistical analysis

Table. 1

		t	df	Sig.	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Egg	Equal variances assumed	41.702 **	29	0.000	3.900	0.094	3.709	4.091
Larvae	Equal variances assumed	12.464 **	29	0.000	1.668	0.134	1.394	1.942
Proto	Equal variances assumed	12.10 **	29	0.000	1.323	0.102	1.115	1.531
Deuto	Equal variances assumed	9.56 **	29	0.000	2.037	0.213	1.600	2.4721
Lifecycle	Equal variances assumed	43.46 **	29	0.000	9.028	0.208	8.602	9.4521
Pre	Equal variances assumed	8.57 **	29	0.000	1.132	0.132	0.86183	1.402
Ovi	Equal variances assumed	1.21 NS	29	0.235	2.282	1.880	-1.56330	6.127
Post	Equal variances assumed	1.17 NS	29	0.251	-.587	0.500	-1.60941	0.437
Longevity	Equal variances assumed	1.44 NS	29	0.161	2.828	1.967	-1.19493	6.851
Lifespan	Equal variances assumed	6.45 **	29	0.000	12.355	1.916	8.43588	16.273
Totalegg	Equal variances assumed	7.92 **	29	0.000	-98.191	12.396	-123.544	-72.838
Eggperday	Equal variances assumed	10.11 **	29	0.000	-8.046	0.796	-9.675	-6.418

Table. 2

	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Fedlcyc	0.562 NS	22	0.580	0.774	1.3774	-2.082	3.631
Fedpre	0.218 NS	22	0.829	-0.8829	4.048	-9.277	7.511
Fedovi	0.849 NS	22	0.405	21.217	25.003	-30.637	73.071
Fedpost	0.788 NS	22	0.439	-2.467	3.131	-8.961	4.025
Fedlong	0.708 NS	22	0.486	17.867	25.22	-34.439	70.1733
Fedls	0.766 NS	22	0.452	19.333	25.251	-33.032	71.698

Tabulated T at 5%= 2.074
at 1%= 2.811

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RESULTS AND DISCUSSION

Data presented in Table (3) showed that *T. urticae* developed faster when reared on *Rosa hybrida* than those reared on *Rosa damascena* and the difference was highly significant. Our data was in accordance with that of Romeih et al. (2013) *who* proved that the developmental time was significantly influenced by the rose cultivars, whereas, Skirvin and Coury-Williams (1999) found that its development times do not differ with plant species. The oviposition period of *T. urticae was* significantly influenced by rose cultivars and Mabella Yellow; cultivar appeared to be the less profitable plant material for rearing *T. urticae* than other rose cultivars used and give a shorter ovipositional period of 15.20 days with highly reproduction yield of eggs and daily mean of 9.03 eggs/day.

Our results are in accordance with Shih *et al*. (1976) who demonstrated that the host plant affects fecundity more than longevity. Shahine and Michelakis (1994) pointed out that no difference in longevity when eggplant, tomatoes and beans are used as hosts, but fecundity is affected by the host plant. Data showed that *Rosa hybrida* was more suitable for *T.urticae* females than *Rosa damascena* and increased the fecundity and daily number of eggs. Romeih *et al*. (2013) proved that *T.urticae* laid the highest daily number of eggs on Eiffel Tower was significantly more than on the other cultivars, total fecundity was significantly difference and was highest on White Queen Elizabeth.Patil *et al*. (2005) reported that females *T. urticae* laid an average of 104 eggs in their oviposition period of 14.5 days when reared on Jasmine. Scouting constituents of Taifʼs rose essential oils from leaves infested with *T. urticae* compared to check in the present study. Results pointed to a higher percentage of sesquterpene up to three- four times to monoterpenes Table 1.Monoterpens found in case of *T.urticae* infested leaves slightly exceeded than that of check. Volatile s emitted in Taifʼs rose reached = 42 compounds in both traits (Table 1). Some Monoterpes such as D limonene, Caryophellene, and its α isomer were reduced but other as Eucalyptol percentage increased three times in infested leaves which conformed with its pesticidal activity as reported by Sfara et al (2009) and Moretti et al. (2015).Similarly observation were obtained concerning Camphor and Anethole. The picture in Sesquiterepene resolute induction of high quantity of compounds such as Farneses and relatively for Ledene, Gama Cadinene, and trans Geranyl Geranyol. The quantities of volatiles emitted from taif rose leave in both treatments are very low and did not conform with other investigations as mentioned by Kürkçüoglua & Baser (2003) (that of *R. damascene* flowers (as the origin of Taifʼs rose) main oil components are geraniole and citronellol as fragrant according to (Internationa Standard ISO9842, 2003 in Kürkçüoglua et al (2013) . Such vast difference between the two source i.e rose leave against flowers as the main reservoir of Taifʼs rose oil besides extraction technique. Kürkçüoglua (2003). Both compounds are characterized by their insecticidal and deterrent effect against the two-spotted spider mite *T.urticae*, on *R. damascene* Mill (Salman and Erba, 2014).

The pictures on *Rosa hybrida* white teneky cultivar are different. Table (2) describes the different substances resolute from the green oil of rose leaves of cultivar; white Tenky, GC/MS. The undamaged leaves of *Rosa hybrida* varied greatly in their concentrations which almost are half those emitted from Taifʼs rose, however the major constituent i.e. myristicin was 51.62 µg/100g of leaves of the total oil. The other higher substance; sabenine amounted to 9.24 µg/100g of leaves in Tenky white, Another picture was found with β-phellandrene which accumulated as traces in white Tenky. However β-sesquiterpne was only 3.81 µg/100g of leaves. But the higher content of Myristicin with higher indsecticidal activity against *Musca domestica* and *Blatta orientalis.* was not present in the infested leaves (Swiech 2013).

When this cultivar were subjected to the damage occurred by infestation with spider mite *T.urticae* , Table (2) represented the different constituents fractionated. Completely other picture was illustrated which seemed that other species or other compounds were found; Table (2a) illustrated this hypothesis. The damaged leaves resoluted totally different substances however varied in concentrations. From the first sight to Table (2a), the major substance found was α-hydroperoxy diethyl ether. An interesting pattern was observed for instance, this substance amounted 25.69, µg/100g of leaves for the oil of damaged leaves with mite of the white cultivar wt. It was found that other these substances occurred in the oil, namely butyl hydroxy toluene, processed the trend similar to that of α-hydrxyperoxy diethylether. Comparing the different compounds fractionated in table (2) many substances were emitted as a cause of infection by the pest which obviously were not the same like in the healthy leaves. From these compounds the followings were emitted with their concentration in the wT cultivars:

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Compounds	White temneky
(1) (Z) 3-hexan-1-01	5.57
(2) α-hydroperoxy diethyl ether	25.69
(3) (Z) and (E) Farnesence	Traces
(4) Linalool	7.91
(5) Methyl salicylate	3.09
Geraniol	2.85

The three former compounds are the constituent of the HIVs and the latter two compounds are the constituents of GLVs. The substances which refer or contribute to attraction to predators are in traces except methyl salicylate amounted to 3.09 µg/100g of leaves. Ament *et al*. (2004) reported that Jasmonate precursors and derivatives or Jasmonic acid itself could induce the emission of volatiles similar to those induced by herbivory such as: 4,8-dimethyl-1,3,7,11 tetraene (TMTT) as well as some monoterpenes like, linalool, and β-ocimene which is observed in the present investigation. In addition JA (Jasmonic acid) or it's methyl ester vapor elevated the emission of volatiles as the predatory mites were attracted. The above mentioned authors proved that JA probably induced the synthesis of the volatiles rather than it was released from storage organs. On the other hand, the monoterpenes α-pinene, β-pinene, α-humulene and β-caryophyllene were only released after mechanical damage.

In conclusion to this part of the present investigation some compounds like HIPVs as well as methyl salicylate and linalool were emitted in response to the infestation with *T. urticae* These compounds were reported by Shimoda (2010) as an attractive to *P. persimilis* in the laboratory. On the other hand when using fosmidomycin to inhibit the biosynthesis and emission of terpenoids, these substances were less attractive to *P. persimilis* than those without the inhibitor treatments. This fact confirmed the role of some terpenoids in the predator attraction. Also, the predator did not discriminate between odors from prey-plant combination and those from *T. urticae* infested mandarin leaves. Another phenomenon was observed is that the predator did not distinguish between the synthetic odor and those emitted from infested leaves. The previous mentioned author revealed that *N. californicus* was attracted to methyl salicylate only at high concentrations. Achuo *et al*. (2004) also mentioned that in tomato and tabac metyl salicylate defense pathway enhanced resistance against many pathogens.

Phenolic compounds in defense against pests

Phenolics are present in all plants, some classes being common to most plant species while the others are family or species specific. The wide occurrence of phenolics suggests an important role in the survival of plants and consequently their defense system. Phenolics may also be involved in the attraction of pollinators, seed distributors, in pollen germination, and in the regulation of auxin transport Taylor and Grotewold (2005). Table (2b) includes different phenolics separated by HPLC technique in the wT cultivar either infested with *T.urticae* or in the undamaged leaves. Almost all the values of the different phenolics determined are lower in the undamaged leaves than that infested by mite, Gallic acid is the most abundant acid found in the three *R. hybrida*, reaching 152.86/ comparing to 166.879 mg/100g of un infested leaves In the second order came Caffiec acid, amounted to 69.84 mg/100g of leaves in and 76.42 in uninfected

No generalization about the function of every phenolic acid can be made because their activity is highly dependent on the particular condition prevailed. However the most important function of hydroxycinnamic acid in disease resistance is their cross linking to the cell walls and acting as precursors for lignin synthesis.

However on the other hand the picture of phenolic acid quantities resulted from Taif's rose Table (1b) are not identical with wT cv. That is a regular induction to synthesis higher quantity of phenolics comparing to check. Some of these compounds were traces in check but duplicated several times due to *T. urticae* infestation such as Luteolin, Vanillic, Caffeic, Cholorgenic acids. Also other phenolic acids as Gallic, catshinec acid Ferulic acids were duplicated and more which in turn reflect the induced resistance or the antibiotic effect of taif rose secondary metabolites. These compounds might reduce *T.urticae* female fecundity as will be seen in table 3.In the same manner the predatory mite *N californicus* -showed normal predacious rate under lab condition may be owing to the intens emittion of attractive volatiles from Taif's rose leaves such as a

farnecene and caryophlene (Table 1) which approached 25 % of the emitted volatiles works as a carnivore attractive, Agrawal *et al*.(2002).

In the global context of sustainability, food safety and environmental protection, such semiochemicals represent an alternative and promising approach to integrated pest management. Shimoda et al. (2005) stated that at least five synthetic components of HIPV methyl salicylat, linalool, and from GLVs (z)-3-hexane-1-ol, (E)-2-hexanal and (Z)-3-hexenyl acetate were separately attractive to the predators in a laboratory study. In another investigation, Shimoda et al. (2005) suggested that a single compound of methyl salicylate or mixtures of this compound and others are good candidate for use in manipulating foraging behavior of mite predator in field.

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