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The Most Important Bioactive Compounds of *Trogoderma granarium* (*Insecta: coleoptera: Dermestidae)* Methanolic Extract Analyzed by GC-MS Technique

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Abstract

Trogoderma granarium's methanolic extract performed GC-MS analysis, and the results revealed 53 bioactive chemical compounds Pentanoic acid, Cyclobutanemethanol, -methyl-, 1,1dimethylpropyl ester (1H)pyrimidinone 5chloro 4 6 diphenyl Hydroxylamine, Nitro 2methyl-1 3 propanediol O (2-methylpropyl) Uridine, Methyl 2phenoxyethylamine, Pentaborane 11, cisMethoxy 5 trans-methyl1R-cyclohexanol Nitro 1phenyl-3(tetrahydropyran2-yloxy) propan 1one cisMethoxy-5-trans-methyl1R-cyclohexanol 2' 3'O (phenylmethylene), acetic acid,2benzoylthio-,2oxo2phenylethyl ester. Methylpropyl, uridine, 2' 3'O (phenylmethylene).5'(4-methylbenzenesulfo, benzeneethanol), Uridine,, acetic acid, methyl(s),2-benzoylthio 2phenylethyl ester, 2oxo-2-phenylethyl ester deoxy L ribose 2 5dibenzoate, Phenacyl thiocyanate Alanine, Methenamine Decyl ester of N-methyl-n-propargyloxycarbonyl, Benzoyl chloride is a kind of benzoyl chloride., Ethanone, thiophene2-ol, benzoate (5-nitrotetrazol-2yl) 2,5-Dimethylhexane-2,5-dihydroperoxide, 1-phenyl, 2,5 Dimethylhexane2,5dihydroperoxide, N-Benzamide is a kind of benzamide (3-benzylthio-124-thiadiazol-5yl) p(2-phenyl 1-benzimidazolyl)benzoate, p(2-phenyl-1benzimidazolyl)benzoate, p(2-phenyl-1-benzimidazolyl)benzo. Secondary materials produced by Trogoderma granarium, may have an important biological effect. Specific chemical signals identified compounds that are released by the beetle can serve as biomarker.

Keywords: *Bioactive Chemical Compounds, GC-MS Technique, Trogoderma Granarium.*

1. Introduction

Trogoderma granarium contaminates non-host cargoa and storing spices, dried gum, seedes, dried fruits and other protein plant materials. This pest is found in relatively trivial numbers and could remain as an inactive instar for a very long time. Larva can feed on many dried stored materials(Hadaway,1955; Bailey,1958)[(7),(4)]. Khapra pest, is worst most stored-product insects in the world, it is known as one of the top 100 disturbing pests in the world (Applebaum *et al*2005; Chaieb *et al* 2007a)[(3),(5)] . *T. granarium* is a harmful insect of stored products at hot dry conditions.Because larvae reproduce quickly, they can be present in enormous numbers in the superficial tiers of stacked bins. When it is discovered in a non-contaminated location, all suspicious commodities are immediately quarantined, and an expensive eradication and control campaign is launched (Harmatha

& Nawrot,1984; Chaiebe *et al*.2007b)[11],[6]. Although they favor cereals and entire grain materials, larvae have been found on the following crops: wheat, barley, and rice. oats, rye, maize, powdered milk, fish, ground almonds, flour, brans, malts, flax seeds, alfalfa seeds, tomatoo seed, black-eyed cowpea, pinto beans, sorghum seed, and grain straw, noodles, cotton seeds, dried fruit, lima beans, coconut, garbanzose, lentils, powder yeast, alfalfa hay, and noodles and other ingredients. due to its protection need habits, controlling this insect in buildings or transporting facilities is extremely difficult, In the larval instar, there is a distinct sort of recurrent dormancy. allows the population can take advantage of food availability and withstand long periods of hunger (Hartmann,1996; Hussein *etal* 2016)[12],[13]. Furthermore,Insecticides and a variety of other chemicals appear to be ineffective against this pest fumigantion, particularly at the larval instar, has steadily expanded its geographic range during the previous century(Sosa *et al*,2016) [15]. (Due to the beetle's abilities to survive for lengthy intervals of time without food with very little moisture content, fixed contaminations are difficult to eradicate. These beetles have the ability to creep into small holes and crevices, where they can dwell for long periods of time, they became almost resistant to pesticides and fumigants(Altameme *et al*, 2015).

2. Materials And Methods

Insect Culture

(3 mm) larvae of khapra were gained from the culture. Wheat flour and beer yeast were fed to the insects in a 95:5 ratio and incubated in the dark at 30°C with an RH of 70%. Adults were btained from Babylon's college of science institution.(Hadi et al,2016; Mohammed et al,2016) (8)(14).To extract secondary components, to the whole-body powder of adults, 100 mL methanol was added. Methanol, the solvent was the control treatment.

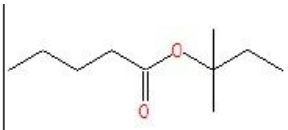
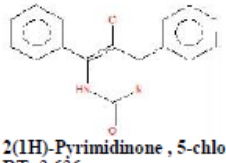
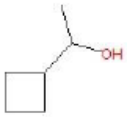
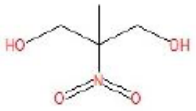
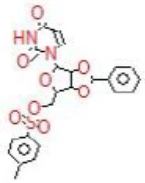
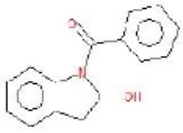
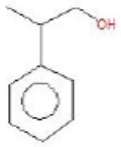
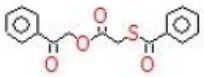
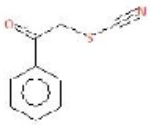
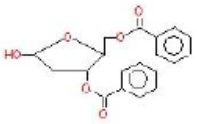
GC – Mass Spectrum Procedure

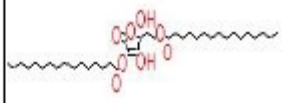
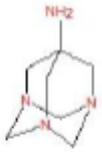
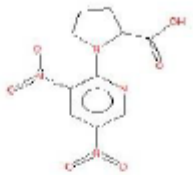
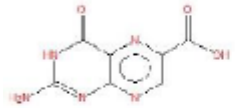
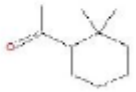
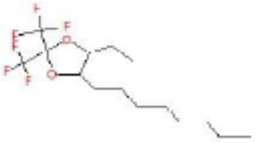
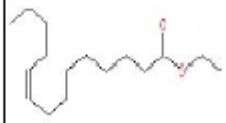
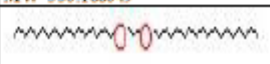
In 70 eV, a tool (Agilent 789 A) is controlled by a computer .For analysis of GC-MS of the T.granarium extract , approximately 1ML of the methanol extract was added to the GC- MS using micro syringes then scanning with 45 min. When elution occurred, the first injection was made. known as Retention time (RT). Helium was utilized as both an envoy and a solvent. The rate of helium flow was fixed at 1 ml per min(Hameed et al,2015; Hameed et al 2017) (10)(9) When compared to the NIST/EPA/NIH and Wiley mass spectral libraries, the chemicals were well-known.

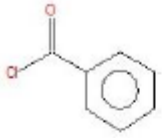
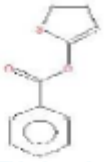
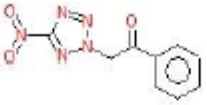
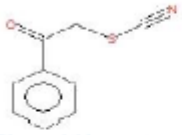
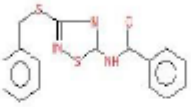
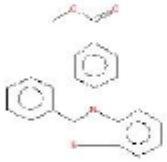
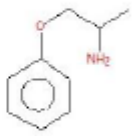
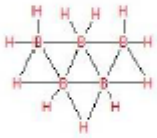
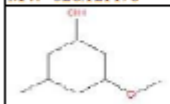
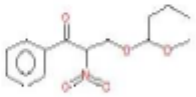
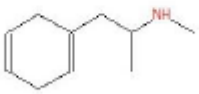
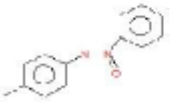
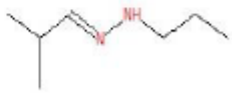
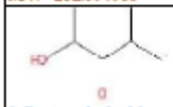
3. Results and Discussion

In methanolic extract of *T. granarium*, gas chromatography analysis and mass spectroscopy constituents were done in Table 1. The compound peaks found in GC-MS chromatogram was shown in Figure 1. The presence of 53 significant peaks was discovered, as was the presence of the compounds there were peaks that corresponded to peaks named as follows. First peak formed were reffered as pentanoic acid, cyclobutanemethanol, methyl-, 1,1dimethylpropyl ester (1H)pyrimidinone 5chloro 4 6 diphenyl Hydroxylamine, Nitro 2methyl-1 3 propanediol O (2-methylpropyl) Uridine, Methyl 2phenoxyethylamine, Pentaborane 11, cisMethoxy 5 trans-methyl1R-cyclohexanol Nitro 1phenyl-3(tetrahydropyran2-yloxy) propan 1one cisMethoxy-5-trans-methyl1R-cyclohexanol 2' 3'O (phenylmethylene), acetic acid,2benzoylthio-,2oxo2phenylethyl ester. Methylpropyl, uridine, 2' 3'O (phenylmethylene).5'(4-methylbenzenesulfo, benzeneethanol), Uridine,, acetic acid, methyl(s)2-benzoylthio 2-phenylethyl ester, 2oxo-2-phenylethyl ester deoxy L ribose 2,5dibenzoate, Phenacyl thiocyanate Alanine, Methenamine Decyl ester of N-methyl-n-propargyloxycarbonyl, Benzoyl chloride is a kind of benzoyl chloride., Ethanone, thiophene2-ol, benzoate (5-nitrotetrazol-2yl) 2,5-Dimethylhexane-2,5-dihydroperoxide, 1-phenyl, 2,5 Dimethylhexane2,5dihydroperoxide, N-Benzamide is a kind of benzamide (3-benzylthio-124-thiadiazol-5yl) p(2-phenyl 1-benzimidazolyl)benzoate, p(2-phenyl-1benzimidazolyl)benzoate, p(2-phenyl-1-benzimidazolyl)benzo.

Table 1. Gas chromatography analysis and mass spectroscopy constituents of methanolic extract of Trogoderma granarium.

 **Decade** Rt=3.247 Mw=142.172151	 **Pentanoic acid , 1,1-dimethylpropyl ester** Rt=3.356 MW=172.14633	 **2(1H)-Pyrimidinone , 5-chloro-4,6-diphenyl-** RT=3.636 MW=282.05599
 **Cyclobutanemethanol , α-methyl-** RT=3.739 MW=100.088815	 **2-Nitro-2-methyl-1,3-propanediol** RT=3.813 MW=135.053158	 **Hydroxylamine ,O-(2-methylpropyl)-** RT=4.311 MW=89.084064
 **Uridine , 2',3'-O (phenylmethylene)- , 5'-(4-methylbenzenesulfo** RT=5.582 MW=486.109686	 **2-Indolinol , 1-benzoyl-** RT=5.725 MW=239.094628	 **Benzeneethanol , β-methyl-,(s)-** RT=6.045 MW=136.088815
 **Acetic acid ,2-benzoylthio-, 2-oxo-2-phenylethyl ester** RT=6.159 MW=314.06128	 **Phenacyl thiocyanate** RT=6.514 MW=177.024835	 **3-Deoxy-L-ribose-2,5-dibenzoate** RT=6.571 MW=342.110338

Mw=136.065493	MW=230.094295	
 Hexadecanoic acid , methyl ester RT=14.628 MW=270.25588	 Cyclopentaneundecanoic acid , methyl ester RT=14.908 MW=268.24023	 l-(+)-Ascorbic acid 2,6-dihexadecanoate RT=15.263 MW=652.49142
 Tridecanoic acid RT=15.389 MW=214.19328	 7-Amino-1,3,5-triazaadamantane RT=15.618 MW=154.121846	 N-[3,5-Dinitropyridin-2-yl]proline RT=15.698 MW=282.060034
 Pterin-6-carboxylic acid RT=15.601 MW=207.039239	 Ethyl undecyl carbonate RT=15.864 MW=15.864	 Eicosanoic acid ,phenylmethyl ester RT=16.047 MW=402.349781
 9-Octadecenoic acid ,(Z)-, methyl ester RT=16.247 MW=296.27153	 Methyl stearate RT=16.470 MW=298.28718	 3-Chloropropionic acid , tridec-2-ynyl este RT=16.648 MW=286.169958
 9-octadecenoic acid , 2,2,2,-trifluoroethyl ester RT=16.745 MW=364.258915	 Ketone , 2,2-dimethylcyclohexyl methyl RT=15.973 MW=154.135765	 2-Undecene , (Z)- RT=16.087 MW=154.172151
 Cis – 13-Octadecenoic acid , methyl ester RT=16.253 MW=296.27153	 1,3-Dioxolane , 4-ethyl-5-octyl-2,2- bis(trifluoromethyl)-,cis- RT=17.071 MW=350.168049	 i-Propyl 9-tetradecenoate RT=17.512 MW=268.24023
 Butyl 9-tetradecenoate RT=17.638 MW=282.25588	 Octadecane , 1,1'-[1,3- propanediylbis(oxy)]bis- RT=21.059MW=580.615833	

 **Methenamine** RT=6.755 MW=140.106196	 **2,2-Diethyl-N-ethylpiperidine** **RT**=6.743 **MW**=169.18305	 **Alanine , N-methyl-n-propargyloxycarbonyl- , decyl ester** **RT**=6.852 **MW**=325.22531
 **Benzoyl chloride** **Rt**=6.995 **Mw**=140.0028925	 **Thiophene-2-ol , benzoate** **RT**=7.264 **MW**=204.024501	 **Ethanone , -(5-nitrotetrazol-2-yl)-1-phenyl-** **RT**=7.767 **MW**=233.054889
 **Phenacyl thiocyanate** **RT**=8.082 **MW**=177.024835	 **2,5-Dimethylhexane-2,5-dihydroperoxide** **RT**=8.174 **MW**=178.120509	 **Benzamide , N-(3-benzylthio-1,2,4-thiadiazol-5-yl)-** **RT**=8.511 **MW**=327.050005
 **Methyl p-(2-phenyl-1-benzimidazolyl)benzoate** **RT**=8.700 **MW**=328.121178	 **1-Methyl-2-phenoxyethylamine** **RT**=9.123 **MW**=151.099714	 **Pentaborane(11)** **RT**=9.066 **MW**=66.132602
 **3-cis-Methoxy-5-trans-methyl-1R-cyclohexanol** **RT**=9.015 **MW**=144.115029	 **2-Nitro-1-phenyl-3-(tetrahydropyran-2-yloxy)propan-1-one** **RT**=9.392 **MW**=279.110672	 **1-(1,4-cyclohexadienyl)-2-methylaminopropane** **RT**=9.638 **MW**=151.1361
 **1-Phenyl-2-(4-methylphenyl)-diazene 1-oxide** **RT**=10.520 **MW**=212.094963	 **Isobutyraldehyde , propylhydrazone** **RT**=11.498 **MW**=128.131349	 **Acetoxyacetic acid ,nonyl ester** **RT**=11.727 **MW**=244.1674595
 **2-Pentanol , 3-chloro-4-methyl -,(R*,R*)-(+)** **Rt**=11.967	 7-Hydroxy-3-(1,1-dimethylprop-2-enyl)coumarin RT=12.425	 Trans-2,3-Epoxyoctane RT=13.375 MW=13.375 MW=128.120115

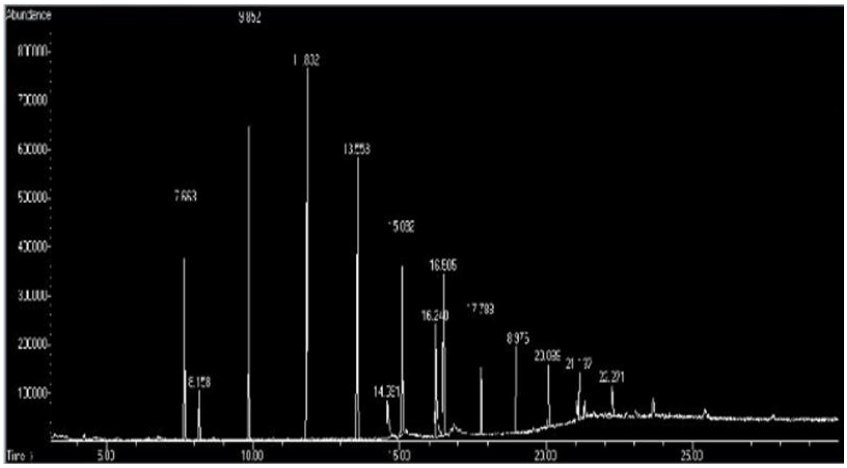


Figure (1) : GC-MS chromatogram of methanolic extract of Trogoderma granarium

Among the most significant insects that affect stored grain materials is, *T. granarium* (Coleoptera, Dermestidae), rice, oat, barley, and rye are examples of leguminous crops arround the world. Since its start, it has spread throughout, Europe, South America, Africa and East Asia(Hameed *et al* 2017) [(9)]. As in FAO data, due to insects and rodent pests, 10 to 25% of the world picked materials are spoiled yearly.About 0.2 to 2.9% of product loss have been recorded between 1 to10.5 months caused by *T. granarium*.(Al-Rubaye *et al*,2017) [(1)].Insecticides that are chemical in nature, such as malathiane, cypermethrine, bifenthrine are used for quick dealing, but are very expensive, not alawayes obtainable and also toxic to humans and environment. Besides, malathiane and cypermethrine not effective as it developes tolerance in stored grain pests, especially in *T. granarium*(Ubaid *et al*,2016;Hameed *et al*,2017).

4. Conclusion

A GC-MS analysis of a methanolic extract of *T. granarium* yielded 53 bioactive chemical components. The potential effectiveness as a fingerprint for insect species A method of early and rapid identification of *T. granarium* in stored products is urgently required to improve control options. Specific chemical signals identified compounds that are released by the beetle can serve as biomarker. This analysis techniques can be widely used in food and flavor industries for the quality assessment of food products. Its also play a role in determining ongoing spoilage of foods.

Conflict of interest:

The authors declare no conflict of interest.

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