

Cuticular hydrocarbons profiles of seven common Egyptian mantis

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ABSTRACT

This is the first chemical taxonomic study of cuticular hydrocarbons of seven common mantis species in Egypt. This study is shedding the light on the role of these chemicals in phylogeny and taxonomy of this charismatic group of Insects.

Key words: cuticular hydrocarbons, cuticular extractions, Empusidae, Eremiaphilidae, Mantidae, Tarachodidae, phylogeny.

INTRODUCTION

The cuticular hydrocarbon and lipids of most insect orders have been investigated to some extent and have served as taxonomic characters since the eighties of the last century (Castner & Nation 1984 & Carlson 1988). Along with their primary role in controlling dehydration, components of these mixtures have been found to act as pheromones and do many other functions in most insect species (Steinmetz *et. al* 2003 & Rolph *et. al* 2005).

As a part of an ongoing study of the taxonomy and ecology of mantis in Egypt (Kamal *et. al* 2010) the cuticular extracts of seven species commonly found in Egypt were investigated. This study forms the first step in studying cuticular hydrocarbons of old world mantis and using the output data for phylogenetic analysis by except the work on most common USA mantis species in the end of last century (Jonesa *et al.* 1997).

MATERIALS AND METHODS

Seven species belong to the four Egyptian families of order Mantodea and represent most common mantis species in Egypt, were used in this study. The specimens were collected from the field by hand picking and killed using ethyl acetate that consider as a solvent and doesn't affect the result.

The seven species, *Blepharopsis mendica* Fabricius (Hc6), *Empusa guttula* Thunberg (Hc3), *Eremiaphila rufipennis* Uvarov (Hc1), *Iris oratoria* Linnaeus (Hc2), *Mantis religiosa* Linnaeus (HC4), *Miomantis paykullii* Stål (Hc5) and *Sphodromantis viridis* Forskal (Hc7), were identified using several keys and species descriptions (Saussure 1971; Innes 1911 & 1912; Giglio-Tos 1927; Ibrahim 1979; Kaltenbach 1982).

Each female specimen was soaked in methylene chloride for about two days for extraction of hydrocarbons found in the mantis cuticle. The concentrated extracts were analyzed by gas chromatography technique (GC). The data were obtained using Dani 1000 Italian GC equipped with 105m×0.25mm ID×0.5µm df 100% dimethylpolysiloxane column. The oven was programmed to run from 60 to 100°C at 15°C/min and from 100 to 310°C at the rate of 15°C/min. the injection temperature

was 250°C using helium (He) as a carrying gas with flow rate 2ml/min splitless injection. The detection occurred by FID detector at 320°C.

The output chromatograms were analyzed and each peak got a symbol from a - u. The peaks with the same retention time in the different species take the same symbol. The presence/absence data obtained were analyzed using probiosys software to create phelograms of the seven species.

RESULT AND DISCUSSION

The results indicated that the cuticular extractions of the seven species contain twenty one kinds of hydrocarbons. The lighter hydrocarbon emitted at retention time 15.6 minutes and the heavier one emitted at retention time 34.9 minutes; 19.04% of the detected hydrocarbons are specific to single species, 4.76% are found in all species under investigation and 76.19% are shared between them. The cuticular extractions of *Sphodromantis viridis* Forskal (Hc7) has the large number of hydrocarbons with 12 types while the extractions of *Empusa guttula* Thunberg (Hc3) has the lowest number with only 9 types (Table 1).

Table 1: The distribution of hydrocarbons peaks among mantis species

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
Ret. Time (m)	15.6 15.9	18.0 18.3	18.7 19.0	20.7 21.0	21.5 21.8	22.7 23.0	23.8 24.1	24.2 24.5	24.9 25.2	25.8 26.1	26.7 27.0	27.7 28.0	28.1 28.4	28.5 28.8	29.3 29.6	29.7 30.0	30.1 30.4	31.1 31.4	32.6 32.9	33.4 33.7	34.6 34.9
Hc1	+		+		+	+	+			+		+		+	+			+	+		
Hc2	+		+		+	+	+	+		+		+			+			+	+		
Hc3				+		+		+	+		+		+			+		+	+		
Hc4	+		+		+	+	+			+		+			+		+	+		+	
Hc5	+		+		+		+	+		+		+			+			+	+		
Hc6	+			+		+		+	+		+		+			+	+	+	+		
Hc7		+	+		+	+	+	+		+		+			+			+	+		+

The seven chosen species are classified according to Ehrmann 2002, Otte & Spearman 2005 and molecular phylogenetic study of Gavin & Michae 2009; *Blepharopsis mendica* Fabricius (Hc6), *Empusa guttula* Thunberg (Hc3) belong to family Empusidae, *Eremiaphila rufipennis* Uvarov (Hc1) belong to family Eremiaphilidae, *Iris oratoria* L. (Hc2) belong to family Tarachodidae, *Mantis religiosa* L. (Hc4), *Miomantis paykullii* Stål (Hc5) and *Sphodromantis viridis* Forskal (Hc7) belong to family Mantidae.

The *phelogenetic* analysis based on the presence and absence of cuticular hydrocarbon types in the seven species (fig 1 & Table 2) divided them into two main clusters: the first one containing (Hc1, Hc2, Hc4, Hc5 and Hc7) and the second cluster containing (Hc3 and Hc6). The first cluster shared between three families Eremiaphilidae, Mantidae and Tarachodidae. The second cluster contains species of family Empusidae.

Table 2: The resemblances index between the seven species

	Hc1	Hc2	Hc3	Hc4	Hc5	Hc6	Hc7
Hc1	100.000						
Hc2	90.476	100.000					
Hc3	33.333	42.857	100.000				
Hc4	80.952	80.952	23.810	100.000			
Hc5	85.714	95.238	38.095	76.190	100.000		
Hc6	33.333	42.857	90.476	33.333	38.095	100.000	
Hc7	76.190	85.714	38.095	66.667	80.952	28.571	100.000

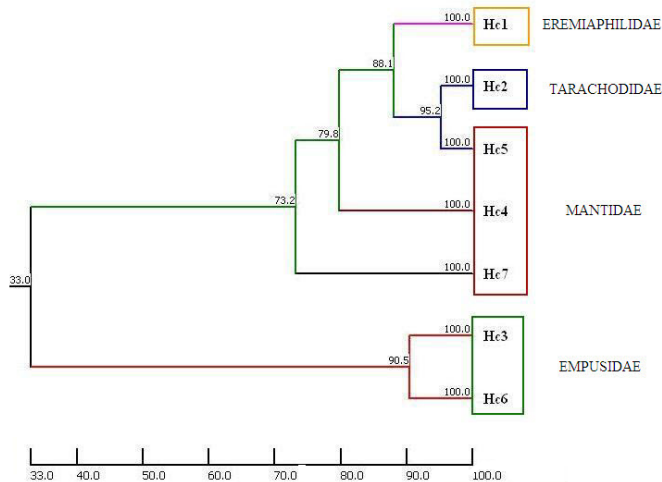


Fig. 1: Showing the phylogram based on presence /absence data of cuticular extractions of the seven mantis species.

The main issues to be discussed about the phylogram induced using data of cuticular hydrocarbons are the clear difference between cuticular extractions of the family Empusidae and the three other families, which reflect the great difference in their morphology; the position of species of family Mantidae in the first cluster reflect their new taxonomic position according to the classification and phylogenetic analysis of Gavin & Michae 2009 as *Mantis religiosa* L. (Hc4) and *Sphodromantis viridis* Forskal (Hc7) belongs to subfamily Paramantinae and two different tribes *M. religiosa* (Mantini) and *S. viridis* (Paramantini), while *Miomantis paykullii* Stål (Hc5) belongs to subfamily Miomantinae; approval of the taxonomic status of *Iris oratoria* Linne (Hc2) is now at stake as its position is more related to family Mantidae than to family Tarachodidae which genus *Iris* transfer to it in classification of Ehrmann 2002, Otte & Spearman 2005 and Gavin & Michae 2009; the difference between genera within family Empusidae and Mantidae can't be clear in our qualitative study but the absence and presence of some types of hydrocarbons between these genera may give an idea about such difference which will appear in more deep qualitative study.

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ARABIC SUMMARY

نُبذة عن هيدروكربونات الجليد لأكثر سبعة أنواع مصرية أنتشاراً من السرعوف

سلوى كمال محمد - سهير محمد جاد الله - هيام عبد الرحمن الحامولى - محمد جمال الدين ناصر
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تعتبر هذه الدراسة من اولى الدراسات التى تجرى على هيدروكربونات الجليد لرتبة السرعوف وذلك على مستوى مصر والعالم، وتشمل الدراسة سبعة انواع من هذه الرتبة تمثل الفصائل الاربعة لهذة الرتبة فى مصر، كما انها الانواع الاكثر انتشارا فى البلاد، وتلقى الدراسة الضوء على دور هذه المركبات فى تصنيف هذه الحشرات الهامة.