A contribution to the knowledge of the Ichneumon wasps (Hymenoptera: Ichneumonidae) from Guilan Province, Northern Iran

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Abstract. In a total of 28 ichneumonid species from 22 genera and 6 subfamilies (Cremastinae, Cryptinae, Ichneumoninae, Pimplinae, Rhyssinae and Tryphoninae) were collected from Guilan province, northern Iran. Of these, one species *Schizopyga podagrica* Gravenhorst is new record for Iran.

Samenvatting. Een bijdrage tot de kennis van de Ichenomindae (Hymenoptera) van de provincie Guilan, Noord-Iran
In het totaal werden 28 soorten Ichneumonidae behorend tot 22 genera en 6 subfamilies (Cremastinae, Cryptinae, Ichneumoninae, Pimplinae, Rhyssinae en Tryphoninae) verzameld in de provincie Guilan, Noord-Iran. *Schizopyga podagrica* Gravenhorst is nieuw voor Iran.

Résumé. Contribution à la connaissance des Ichneumonidae (Hymenoptera) de la province de Guilan, Iran septentrional
Au total 28 espèces d'Ichneumonidae furent capturées dans la province de Guilan, Iran septentrional, appartenant à 22 genres et 6 sous-familles (Cremastinae, Cryptinae, Ichneumoninae, Pimplinae, Rhyssinae et Tryphoninae). *Schizopyga podagrica* Gravenhorst est mentionné ici pour la première fois d'Iran.

Keywords: Ichneumonidae – Fauna – Faunistics – Guilan Province – Iran.

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Introduction

The Ichneumonidae are one of the most species-rich families of all organisms with an estimated 60,000 species in the world (Townes 1969). According to Gauld (1991) many authorities regard this figure as an underestimate. An estimated 12,100 species of Ichneumonidae occur in the Afrotropical region, of which only 1,815 had been described by 1973 (Townes and Townes 1973). Subsequently the single major revision of Afrotropical ichneumonids added a further 70 species of Ophioninae (Gauld and Mitchell 1978), with the result that only an estimated 15% of the Afrotropical ichneumonids are known to science. The ichneumonid fauna of Iran is rather poorly known (Kolarov and Ghahari 2005, 2006, 2007, 2008; Ghahari et al. 2010). The Ichneumonidae, along with other groups of parasitic Hymenoptera, are purported to be no more species rich in the tropics than in the Northern Hemisphere temperate regions (Owen and Owen 1974, Janzen 1981, Janzen and Pond 1975), although a number of hymenopteran families, for example the Chalcididae (Hespenheide 1979) and Encyrtidae (Noyes 1989b) exhibit an increase in species richness with a decrease in latitude. Other hymenopteran taxa such as sawflies (Symphyta), gall-forming Cynipidae, and bees (Apoidea) peak in species richness at mid- or high latitudes (Michener 1979; Noyes 1989b; Kouki et al. 1994). Considerable debate has centered on the apparent species richness anomaly exhibited by a number of hymenopteran parasitoid taxa in the tropics (e.g. Morrison et al. 1978, Gauld 1991, Gauld and Gaston 1994).

The family Ichneumonidae is currently split into 37 subfamilies, of which 24 have been recorded from the Afrotropical region (Yu 1998). Ichneumonids utilise a diverse array of insects and arachnids as their hosts and play an essential role in the normal functioning of most ecosystems, underlining the need to inventory their diversity. Comprehensive, quantitative, biodiversity surveys will enable the identification of hotspots of species richness and endemism. This essential base line data will enable informed conservation management decisions.

The objective of this research is determining of ichneumonids' fauna in Guilan province, northern Iran (Fig. 1). Guilan is one of the provinces of Iran. It lies along the Caspian Sea, just west of the province of Mazandaran, east of the province of Ardabil, north of the provinces of Zanjan and Qazvin. At the center of the province is the main city of Rasht. Other towns in the province include Astara, Astaneh-Ashrafieh, Fooman, Lahijan, Langrood, Masouleh, Manjil, Roodbar, Roodsar, Shaft, Talesh, and Some'e Sara. Guilan has a humid temperate climate with plenty of annual rainfall. The city Rasht which is the center of the province is well-known globally as the "City of Silver Rains" and also known as the "City of Rain" around Iran. The Alborz range provides further diversity to the land in addition to the Caspian coasts. The amount of humidity is truly high in the warm seasons of the year in Guilan, however the coastlines are much cooler and pleasant at the same time and thousands of domestic and foreign tourists come to the seashore for swimming and camping. Despite of the abundant humidity, Guilan is known for its moderate, mild and Mediterranean-like climate. Large parts of the province are mountainous, green and forested. The coastal plain along the Caspian Sea is similar to that of Mazandaran, mainly used for rice paddies.

Materials and Methods

The Ichneumonidae were sampled using Malaise traps, yellow pan traps, sweep netting and hand collecting at each of the sampled regions on Guilan province. In some station a yellow plastic bowl (165 mm diameter 40 mm depth) was placed on the forest floor and charged with propylene glycol. These yellow pan traps were left for 5 days and serviced at the end of this period, with each station being retained as a separate sample. Four Malaise traps were deployed at each region and serviced each day for a period of seven days. The Malaise traps were constructed to the specifications of the Townes design (Townes 1972), and made with a fine-meshed netting (grid size 0.2 mm), with black walls and a white roof. The collection of these samples was spaced over a period of 5 days at each region. Each sweep was conducted in previously unsampled vegetation. The sweep net used for sampling was based on the design of Noyes (1982), with an opening area of ca. 1300 cm2, and a collecting bag constructed from fine-meshed netting with a grid size of 0.2 mm. Also, the information concerning the species' name, describer, locality and the date of collection, place which the material was collected and the altitude (in brackets) was also given. The collected specimens by the first author and some other Iranian researchers were confirmed by Dr. J. Šedivý (Research Institute for Crop Protection, Praha, Czech Republic) and by the second author, and they are preserved in his collection. Classification, nomenclature and distributional data of Ichneumonidae suggested by Yu et al. (2005) and Kasparyan (1981a, b) have been followed.

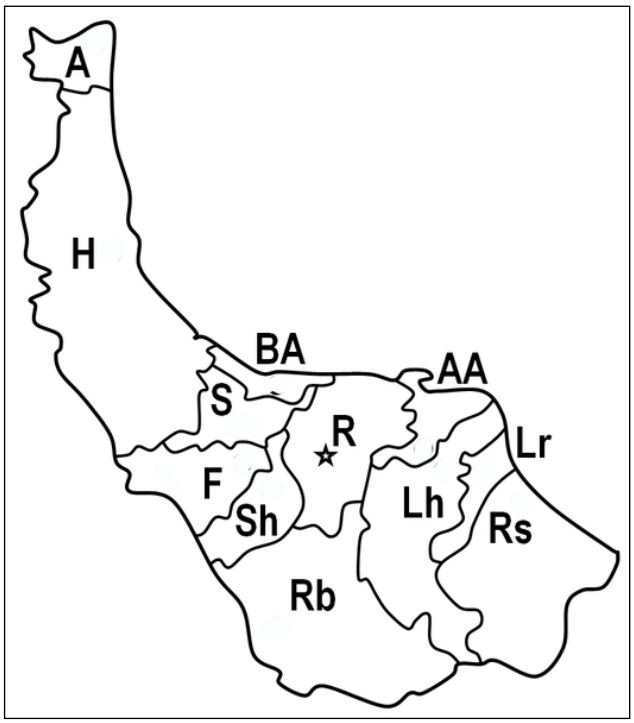

Fig. 1.– Guilan province with its cities [A: Astara, AA: Astaneh-Ashrafieh, BA: Bandar-Anzali, F: Fooman, H: Hashtpar, Lh: Lahijan, Lr: Langrood, R: Rasht (Center of province), Rs: Roodsar, Rb: Roodbar, S: Some'e Sara, Sh: Shaft, M: Masal].

Results

Totally 28 ichneumonid species from 22 genera and 6 subfamilies were collected from Guilan province. The list of species with distributional data is given below.

Subfamily **Cremastinae**

Cremastus pungens Gravenhorst, 1829

Material: Talesh (77 m), 3♀, September 2007. General distribution: Europe, Turkey, Mongolia and Siberia.

Temelucha caudata (Szépligeti, 1899)

Material: Astara (-8 m), 1♀, September 2007. General distribution: Middle and South Europe and Turkey.

Temelucha discoidalis (Szépligeti, 1899)

Material: Astara (-19 m), 1♂, September 2007. General distribution: Europe and Turkey.

Temelucha tricolorata Sedivy, 1968

Material: Bandar-Anzali (-15 m), 2♀, July 2007. General distribution: Canary Islands, Turkey and Afghanistan.

Subfamily **Cryptinae**

Agrothereutes fumipennis (Gravenhorst, 1829)

Material: Rasht (39 m), 1♂, August 2008. General distribution: Palaearctic region.

Aritranis longicauda (Kriechbaumer, 1873)

Material: Roodsar (9 m), July 2007. Langrood (16 m), 2♂, September 2006. General distribution: Europe and Algeria.

Gambrus incubitor (Linnaeus, 1758)

Material: Masal (70 m), 1♂, July 2007. General distribution: Palaearctic and Ethiopian region

Hoplocryptus quadriguttatus (Gravenhorst, 1829)

Material: Some'e Sara (25 m), 1♂, September 2006. General distribution: Europe and Turkey.

Ischnus migrator (Fabricius, 1775)

Material: Astara (-19 m), 1♂, September 2007. General distribution: Palaearctic region.

Mesostenus albinotatus Gravenhorst, 1829

Material: Rasht (127 m), 2♀, August 2008. General distribution: Holarctic region.

Mesostenus transfuga Gravenhorst, 1829

Material: Roodbar (213 m), 1♀, 1♂, July 2007. General distribution: Western Palaearctic region.

Stenarella domator (Poda, 1761)

Material: Roodsar (2 m), 1♀, June 2007. General distribution: Western Palaearctic region.

Trychosis neglecta (Tschek, 1871)

Material: Rasht (39 m), 1♀, August 2008. General distribution: Europe and Turkey.

Trychosis priesneri Rossem, 1971

Material: Langrood (16 m), 1♂, September 2006. General distribution: France, Switzerland, Austria, Poland, Former Yugoslavia, Greece and Turkey.

Subfamily **Ichneumoninae**

Barichneumon incubitor Zetterstedt var. *caucasica*, 1893

Material: Fooman (34 m), August 2008. General distribution: Azerbayjan.

Thyraeella collaris Gravenhorst, 1889

Material: Astara (-19 m), 2♀, September 2007 ex *Plutella xylostella* Linnaeus (Plutellidae). General distribution: Central Asia (Turkmenia), Southwest Asia, West Europe, the Canary Islands.

Phaeogenes ophthalmicus Wesmael, 1844

Material: Rasht (127 m), 1♀, August 2008. General distribution:

Protichneumon pisorius Linnaeus, 1903

Material: Lahijan (12 m), 2♀, July 2007. General distribution: Kazakhstan, Siberia, Western Europe, Turkey, Iran, Afghanistan (13).

Subfamily **Pimplinae**

Exeristes arundinis (Kriechbaumer, 1887)

Material: Fooman (34 m), 1♀, August 2008. Astaneh-Ashrafieh (-27 m), 1♀, September 2006. General distribution: Middle and South Europe, Latvia, Kazakhstan, Middle Asia, Mongolia and Pacific Cost of Russia.

Schizopyga podagrica Gravenhorst, 1829

Material: Rasht (39 m), 2♀, August 2008. New record for Iran. General distribution: Palaearctic.

Subfamily **Rhyssinae**

Rhyssa amoena Gravenhorst, 1829

Material: Roodsar (2 m), 2♂, July 2007. Lahijan (12 m), 1♂, 1♀, June 2007. General distribution: R. amoena has a European and eastern Palaearctic distribution.

Megarhyssa superba (Schrank, 1781)

Material: Talesh (77 m), 1♂, 1♀, September 2007. General distribution: European and eastern Palaearctic distribution.

Subfamily **Tryphoninae**

Cosmoconus (***Cosmoconus***) ***elongator*** (Fabricius, 1775)

Material: Bandar-Anzali (-15 m), 1♂, June 2007. General distribution: Palaearctic region.

Tryphon (***Tryphon***) ***thomsoni*** Roman, 1939

Material: Some'e Sara (25 m), 1♂, 1♀, September 2006. Lahijan (12 m), 1♀, June 2007. Rasht (76 m), 2♂, August 2008. General distribution: Europe, Azerbaijan, Georgia, Turkey, Armenia, Israel, Tajikistan and Siberia.

Tryphon (***Symboethus***) ***brunniventris*** Gravenhorst, 1829

Material: Rasht (76 m), 1♂, August 2008. General distribution: Palaearctic region.

Ctenochira haemosterna (Haliday, 1839)

Material: Fooman (34 m), 1♀, August 2008. General distribution: Holarctic region.

Erromenus analis Brischke, 1871

Material: Roodsar (9 m), 2♀, June 2007. General distribution: Holarctic region.

Erromenus punctulatus Holmgren, 1857

Material: Rasht (76 m), 1♀, August 2008. General distribution: Holarctic region.

Discussion

The results of this research indicated that the fauna of ichneumonids in Guilan province is very diverse. The sampling sites were located at minimum -27 m and maximum 127 m altitudes. In this study we collect only the adult wasps by different methods while determining of their hosts is necessary and can be a research project for other researchers. In this case collecting the larvae and pupae of different pests, especially Lepidoptera, and rearing them in optimum condition is the main method.

Of the four methods deployed to collect ichneumonid wasps, sweeping was the most efficient in terms of procured species richness and abundance, followed by Malaise trapping; yellow pan trapping was extremely inefficient, and was superseded by hand collecting. Smoothed, species-accumulation curves showed that sweeping was the most efficient method in procuring species per sampling effort followed by hand collecting, Malaise trapping and lastly yellow pan trapping. Conversely, plotting cumulative species against abundance showed that all four methods were similarly efficient in returning species per number of specimens captured. Malaise trapping and hand collecting slightly superseded sweeping and yellow pan trapping. Species richness estimators indicated that the deployed sampling methods procured between 19 and 38% of expected species richness (Noort 2004). Malaise traps are a form of flight interception trap which are generally considered to be the best means of obtaining large, general samples of Ichneumonidae from most habitats (Fitton *et al*. 1988), and which have been used extensively for this purpose (Owen & Owen 1974, Noyes 1989a, b, Bartlett *et al*. 1999, Sperber *et al*. 2004). These traps sample the field-herb layer and only provide data on assemblages using or flying through this part of the woodland. The trap operates continuously and may be left unattended (Fitton *et al*. 1988) therefore allowing the collection of multiple samples over the same time period (Mayhew *et al*. 2009).

There was considerable variation in species' abundance and occupancy in our collections. Our previous analyses of the collections have shown that species that were collected from only a few sites or traps tended to be found in low abundance there, such that rare species (in our samples) tend to be rare in both senses (see Fraser *et al*. 2008). This is a small-scale illustration of the more widely known phenomenon of extinction-risk double-jeopardy whereby low abundance and restricted distributions can make species vulnerable to extinction from different sources of threat (Gaston 1999). Parasitoid wasps are already expected to be especially vulnerable to extinction due to their host specificity and high trophic status (Shaw & Hochberg 2001), and the double-rarity indicated in our data may add to this vulnerability. However, rarity in our catch might not necessarily mean that species are rare more generally: they might not be effectively sampled by Malaise traps, or might have peak flight seasons outside our sample period (Mayhew *et al*. 2009).

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