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A Contribution to subfamilies Cremastinae, Cryptinae and Phuridinae from Northwestern Iran

H. GHAHARI, R. JUSSILA & J. ŠEDIVÝ

A b s t r a c t : Upon the faunistic surveys on three subfamilies of Ichneumonidae (Hymenoptera) including, Cremastinae, Cryptinae and Phuridinae in some regions of northwestern Iran, totally 22 species from 13 genera were collected. Of these three species including, *Temelucha lucida* (SZÉPLIGETI), *Hoplocryptus confector* (Gravenhorst) and *Phaestacoenitus caucasicus* KASPARYAN are new records for Iran.

K e y w o r d s : Ichneumonidae, Cremastinae, Cryptinae, Phuridinae, Fauna, new record, Northwestern Iran.

Introduction

Family Ichneumonidae (Hymenoptera) is one of the largest families of insects, with thousands of species worldwide. There are numerous subfamilies, but the classification has not reached a stable consensus. The family Ichneumonidae is currently split into 37 subfamilies (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 (NOORT 2004). All are parasitic on or in other insects. The mode of parasitization is varied: some are solitary, others gregarious; some are koinobionts, others idiobionts; larvae of some feed as ectoparasitoids, others as endoparasitoids; some attack exposed caterpillars or other insect larvae, others attack concealed larvae (borers, miners) or spiders' egg sacs or insect pupae in cocoons or tunnels or soil (GAULD 1991, YU 1998, NOORT 2004). In the family Ichneumonidae, 24 subfamilies are only known to contain solitary species, seven are polymorphic, and clutch size is unknown for three (MAYHEW 1998).

The objective of this paper which is a part of huge project "Iranian Ichneumonidae" established by the first author, is determining of three ichneumonid subfamilies including, Cremastinae, Cryptinae and Phuridinae in Northwestern Iran (Ardabil, East Azarbayjan, West Azarbayjan and Zanjan provinces).

Materials and Methods

The materials were collected by sweeping net and malaise traps by some Iranian researchers from northwestern Iran including, Ardabil, East Azarbayjan, West Azarbayjan and Zanjan provinces. Additionally many collected specimens by the students of the first author and also many specimens of insect collection of some universities were checked. The collected specimens were killed with ethyl acetate and mounted on triangular labels and were examined with a stereoscopic binocular microscope. Confirmation of specimens was made by Dr. J. Šedivý of Czech Republic. Classification, nomenclature and distributional data of Ichneumonidae suggested by YU et al. (2005) and KASPARYAN (1981a, b) have been followed.

Results

In total 22 ichneumonid species from the subfamilies Cremastinae, Cryptinae and Phuridinae were collected from some regions of Northwestern Iran. The list of species with their distributional data is given below.

Subfamily C r e m a s t i n a e

Eucremastus collaris NAROLSKY 1990

M a t e r i a l : West Azarbayjan province: Khoy, 1♀, July 2007.

D i s t r i b u t i o n o u t s i d e I r a n : Greece, Turkey, Georgia, Azerbaijan, Armenia.

Temelucha decorata (GRAVENHORST 1829)

M a t e r i a l : East Azarbayjan province: Mianeh, 1♀, September 2005. Zanjan province: Mahneshan, 1♀, Unknown date.

D i s t r i b u t i o n o u t s i d e I r a n : Madeira and Canary Islands, North Africa, Europe, Azerbaijan, Turkey, Cyprus, Israel, Uzbekistan, Afghanistan, USA.

Temelucha lucida (SZÉPLIGETI 1899)

M a t e r i a l : West Azarbayjan province: Ourmieh, 1♀, July 2007. **New record for Iran.**

D i s t r i b u t i o n o u t s i d e I r a n : Czech Republic, Hungary, Bulgaria, Moldavia.

Temelucha signata (HOLMGREN 1860)

M a t e r i a l : West Azarbayjan province: Ourmieh, 1♀, June 2007.

D i s t r i b u t i o n o u t s i d e I r a n : Europe, Mongolia, Turkey.

Subfamily C r y p t i n a e

Agrothereutes hospes (TSCHEK 1871)

M a t e r i a l : West Azarbayjan province: Ourmieh, 1♂, 1♀, June 2007.

D i s t r i b u t i o n o u t s i d e I r a n : Europe, Turkey.

***Aritranis claviventris* (KRIECHBAUMER 1894)**

Material: West Azarbayjan province: Salmas, 1♂, June 2007.
Distribution outside Iran: Europe, Turkey.

***Aritranis director* (THUNBERG 1824)**

Material: Ardabil province: Aslandooz, 2♂♂, July 2008.
Distribution outside Iran: Holarctic region.

***Aritranis nigrifemur* (SZEPLIGETI 1916)**

Material: West Azarbayjan province: Piranshahr, 1♀, September 2007.
Distribution outside Iran: Europe, Turkey.

***Buathra laborator* (THUNBERG 1824)**

Material: Ardabil province: Meshkinshahr, 1♂, unknown date.
Distribution outside Iran: Holarctic region.

***Buathra tarsoleucos* (SCHRANK 1781)**

Material: Zanjan province: Zanjan, 1♀, September 2006.
Distribution outside Iran: Palaearctic region.

***Cryptus spinosus* GRAVENHORST 1829**

Material: West Azarbayjan province: Maco, 1♀, August 2007.
Distribution outside Iran: Western Palaearctic region.

***Cryptus spiralis* (GEOFFROY 1785)**

Material: East Azarbayjan province: Jolfa, 1♀, unknown date. Zanjan province: Khorram-darreh, 1♀, October 2006.
Distribution outside Iran: Palaearctic region.

***Hoplocryptus confector* (GRAVENHORST 1829)**

Material: West Azarbayjan province: Mahabad, 1♂, August 2007. **New record for Iran.**
Distribution outside Iran: Europe.

***Ischnus agitator* (OLIVER 1792)**

Material: West Azarbayjan province: Salmas, 1♀, June 2007.
Distribution outside Iran: Europe, Tunisia, Turkey.

***Meringopus pseudonymus* (TSCHEK 1872)**

Material: West Azarbayjan province: Piranshahr, 2♀♀, September 2007.
Distribution outside Iran: Europe, Algeria, Turkey, Israel, Jordan, Tadjikistan.

Meringopus titillator rhodius (DALLA TORRE 1902)

M a t e r i a l : East Azarbayjan province: Tabriz, 1♀, September 2006.

D i s t r i b u t i o n o u t s i d e I r a n : Croatia, Greece, Turkey, Armenia, Russia-Dagestan, Azerbaijan, Turkmenistan, Iran, Afghanistan, Syria, Jordan, Palestine.

Mesostenus grammicus GRAVENHORST 1829

M a t e r i a l : West Azarbayjan province: Maco, 1♀, August 2007.

D i s t r i b u t i o n o u t s i d e I r a n : Western Palaearctic region.

Myrmeleonostenus italicus (GRAVENHORST 1829)

M a t e r i a l : West Azarbayjan province: Khoy, 2♀♀, July 2007.

D i s t r i b u t i o n o u t s i d e I r a n : Western Palaearctic region.

Trychosis atripes (GRAVENHORST 1829)

M a t e r i a l : West Azarbayjan province: Ourmieh, 1♀, August 2008.

D i s t r i b u t i o n o u t s i d e I r a n : Western Palaearctic region.

Trychosis legator (THUNBERG 1824)

M a t e r i a l : Ardabil province: Ardabil, 1♂, Unknown date. Zanjan province: Zanjan, 2♀♀, 1♂, September 2006.

D i s t r i b u t i o n o u t s i d e I r a n : Palaearctic region.

Subfamily P h u r i d i n a e

Phaestacoenitus caucasicus KASPARYAN 1983

M a t e r i a l : East Azarbayjan province: Arasbaran, 1♂, June 2006. **New record for Iran.**

D i s t r i b u t i o n o u t s i d e I r a n : Azerbaijan, Georgia.

Phaestacoenitus niger nitidus KASPARYAN 1983

M a t e r i a l : East Azarbayjan province: Aasbaran, 1♀, June 2006.

D i s t r i b u t i o n o u t s i d e I r a n : North Caucasus.

Discussion

Serial studies have been made on the fauna of Ichneumonidae in Iran by KOLAROV & GHAHARI (2005, 2006, 2007, 2008) and GHAHARI et al. (2010). The present research is based on the materials collected recently in some regions of Northwestern Iran by the first author and also some other Iranian researchers. The result indicates that the fauna of Iranian Ichneumonidae is very diverse and several other faunal surveys are necessary for completing the fauna of Iran. Northwestern Iran included various geographical areas and climates and therefore with very diverse flora and fauna which the fauna of natural enemies especially ichneumonids must be determined step by step. Identification of natural enemies' fauna is the first step of successful management and control of agricultural pests in biological control and IPM programs (GHAHARI et al. 2008). The challenge for the biological control research and extension community therefore is to enable small and medium scale farmers to access and use the wealth of biological control knowledge accumulated and to make this work for them. Failure to look at pest management problems and solutions from the point of view of smallholders, compounded by poor linkages between research, extension and farmers, is one of the reasons for the limited adoption of IPM, including biological control technologies (LIM 1992, STOLL 1992, NRI 1995). Successful implementation of IPM needs to focus not only on field research and farmer training from a farmer-first perspective, but also on raising biological control and IPM awareness among government and other decision-makers responsible for pesticide registration and regulation (WILLIAMSON 1998).

The pesticide residue is a substance or a mixture of substances in food, feed, soil, water and air originating from the use of pesticides and includes the specified degradation and conversion products, metabolites, reaction products and impurities. These are considered to be of toxicological significance and have varying duration of persistence. Pesticides with longer persistence exert the desired effect for a longer duration but influence the non-targeted organisms also by entering their bodies through air, water and food. This problem becomes more acute with systemic pesticides which tend to accumulate in the system to attain toxic levels. While the use of pesticides has become indispensable for protecting the agricultural produce from pest damage, their indiscriminate use has polluted almost all conceivable habitats. Almost the pesticides especially organochlorine group can find their way into cereals, vegetables, fruits, pulses and oil seeds as well as in soil, water and animal tissues (ROY 2002, IMANI & GHAHARI 2010).

Since most crop systems have some level of pesticide inputs, and thus we are more frequently concerned with integrated control. In this way, we must promote and conserve the natural enemies by protecting them in some manner from the pesticide inputs. Thus, we need to preferentially choose and use pesticides that are inherently selective, or use the pesticide in a selective manner. Of the three types of selectivity covered (physiological selectivity, behavioral selectivity and ecological selectivity), ecological selectivity lends itself the most to integration into an IPM program. We can develop the appropriate knowledge of biology and stage-specific toxicity of pesticides, and these may give us the tools to alter timing or placement of the otherwise toxic pesticides. Physiological and behavioral selectivity (either inherent or developed through selection) are chance occurrences, over which we have little or no control. The exception would be the case where a natural enemy is either transgenically imbued with resistance, or is deliberately selected in greenhouse colonies by repeated exposure to promote resistance.

In general, parasitoids tend to be more susceptible to insecticides than predators, and the organophosphates as a group, tend to be broadly toxic to natural enemies. That said, generalizations are of very little use in constructing specific integrated management programs.

Most biological control agents, including predators and parasitoids, at work in our agricultural and urban environments are naturally occurring ones, which provide excellent regulation of many pests with little or no assistance from humans. The existence of naturally occurring biological control agents is one reason that many plant-feeding insects do not ordinarily become economic pests. The importance of such agents often becomes quite apparent when pesticides applied to control one pest cause an outbreak of other pests because of the chemical destruction of important natural enemies. There is great potential for increasing the benefits derived from naturally occurring biological controls, through the elimination or reduction in the use of pesticides toxic to natural enemies.

Problems associated with reliance on chemical control include the development of pesticide resistance in important pest species. This encourages an increase in dosage and number of pesticide applications which magnifies the adverse effects on natural enemies. Pests may also resurge because of the destruction of predators and parasitoids, breeding without restraint from natural enemies. A secondary pest outbreak may occur when natural enemies of a pest, which were not the target of the application, are destroyed. The second species, released from the pressure imposed by its enemies now may increase to damaging numbers and require further insecticidal treatment. If pesticides eliminate natural enemies, populations of pests may increase dramatically. There is the potential for these pests for emigration to surrounding habitats, and they may end up damaging crops at considerable distances from the site where the application took place. The impact of pesticides may extend over long periods of time and large areas or may last until the delicate numerical balance is reestablished. If pesticides are used often, the normal balance may never be achieved.

Pesticides often inflict severe mortality on both pest and natural enemy because of their basic physiological similarities they are both arthropods. There can also be indirect impacts through destruction of alternative prey. Pesticides influence the biology of insects in even more subtle ways and may affect their development, egg production, and the ability to find prey. However, much less is known about the effects of chemical pesticides on natural enemies than on pests because the pest is usually the primary object of pesticide research. Natural enemies come in contact with pesticides through a variety of means, including direct exposure to the chemical, contact with the pesticide residue, or through the food chain. Parasitoids or predators may encounter fallout of the toxicant while on plants or soil surfaces or while flying. They may also ingest the toxic material while feeding on plant material to obtain nutrients or water, through predation, through host feeding by adult parasitoids, or as immature parasitoids consuming the host. The greater susceptibility of natural enemies to low concentrations of pesticides often means that during reentry into treated habitats, predators and parasitoids are subjected to toxic residues longer than the pests. Pesticides also have sublethal effects on natural enemies. Herbicides, fungicides and all major classes of insecticides may reduce feeding, egg laying, or egg hatch. The developmental rate may be lengthened or the sex ratio changed resulting in fewer females produced, and there may be behavioral effects on prey searching, prey acceptance, and mobility. Although the focus of pesticide studies has been on the mortality of isolated species, the shift to IPM requires that the diverse and often subtle pesticide side-effects among the plant, pest, and natural enemy be more thoroughly investigated.

Manipulation of the formulation can limit or direct the distribution of pesticide residues and can influence its uptake and penetration in the natural enemy. The side-effects on natural enemies are highest with emulsifiable concentrates and wettable powders. Baits and seed treatments can drastically decrease pesticide residues in the environment in addition to concentrating chemicals where they are effective and selective. Granular materials may also control pests selectively while conserving natural enemies through spatial separation of the pesticide and natural enemy.

Pesticide resistance has been observed in some beneficial insects and mites and has been more commonly reported for predators than parasitoids. From an IPM perspective, resistance levels in natural enemies often must be substantial (10 to 100 fold) before significant selectivity benefits can be obtained in the field because natural enemies are often intrinsically more susceptible than are pests. Lower levels of resistance may be of some value in achieving pesticide selectivity when combined with ecological selectivity, and in allowing the reentry of natural enemies from refuges or sheltered areas into treated habitats as pesticide residues are dissipating. The potential for genetic improvement of resistance by altering genetic characteristics of a species through hybridization, artificial selection or genetic engineering has been a major stimulus in pesticide resistance research on beneficial organisms.

The successful combination of pesticide use and biological control in an IPM program is dependent more on knowledge of the system the ecology and the behavior of pests and natural enemies than on the availability of tools and techniques. The best approach to preserving effective biological control of natural enemies is a combination of tactics including an understanding of the biology and behavior of arthropods, detailed monitoring of life history and population dynamics of pests and natural enemies, employment of selective pesticides, use of the least disruptive formulation of the pesticide, application only when absolutely necessary, basing chemical control on established economic injury levels, and application at the least injurious time. By conserving and protecting natural enemies we permit them to operate to their full potential as naturally occurring sources of biological control in the urban and agricultural environment. There are still a few good quality guides to natural enemy recognition and their use in IPM in different regions of the world, and also in Iran. However the main topic in biological control and IPM programs is supporting these beneficial activities for encourage of the researchers and farmers.

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Zusammenfassung

Im Rahmen faunistischer Erfassungen der drei Ichneumonidenunterfamilien Cremastinae, Cryptinae und Phuridinae im Nordwesten des Irans, konnten 22 Arten aus 13 Gattungen nachgewiesen werden, von denen die drei Spezies *Temelucha lucida* (SZÉPLIGETI), *Hoplocryptus confector* (GRAVENHORST) und *Phaestacoenitus caucasicus* KASPARYAN Neunachweise für den Iran darstellen.

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Author's addresses:

Hassan GHAHARI
Department of Entomology
Islamic Azad University
Science & Research Branch
Tehran, Iran
E-mail: hghahari@yahoo.com

Reijo JUSSILA
Zoological Museum
Section of Biodiversity and Environmental Sciences
Department of Biology
FI-20014 University of Turku Finland
E-mail: reijo.jussila@utu.fi

Josef ŠEDIVÝ
Research Institute for Crop Protection
16106 Praha 6-Ruzyne
Czech Republic
E-mail: sedivy@vurv.cz