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A contribution to the biodiversity of weevils (Coleoptera: Curculionidae) in Iranian cotton fields and surrounding grasslands

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Abstract: In a total of thirty three species of nine genera (*Ceutorhynchus*, *Curculio*, *Tychius*, *Hypera*, *Otiorhynchus*, *Larinus*, *Lixus*, *Coniatus* and *Donus*) and four subfamilies (Curculioninae, Entiminae, Lixinae and Phytonominae) of Curculionidae were collected from Iranian cotton fields and surrounding grasslands. In addition to the curculionid species, their host plants are given too.

Key words: Coleoptera, Curculionidae, Cotton field, Iran.

Introduction

Weevils are classified as the superfamily Curculionoidea, which contains about 60.000 species and 6.000 described genera (THOMPSON 1992; KUSCHEL 1995). With its sister group Chrysomeloidea, the weevils constitute a radiation of phytophagous insects rivaled in species diversity only by the Lepidoptera (FARRELL 1998a, 1998b). The Curculionoidea is one of the richest groups in terms of potential for insights into the evolution of diversity and remains one of the more challenging taxonomic groups in terms of stability of classification (ANDERSON & O'BRIEN 1996; MARVALDI et al. 2002). The Curculionidae represent one of the most stunning radiations of animals and thus figure prominently among the phenomena to be explained (MAYR 1963). Collectively, weevils use every plant part and nearly every plant taxon (ANDERSON 1995), and yet related species are often similar in host use. Weevils constituting various taxonomic groups feed on plant roots, stems, leaves, flowers, fruits, or seeds. They may be among the first enemies to consume healthy plants or may be specialists on decaying tissues or the dead remains of plants felled by other causes (FARRELL et al. 2001; LANTERI et al. 2002). Taxonomic groups of weevils are also often restricted to particular host groups, specializing on conifers, cycads, dicots, or monocots or on subsets of these plant taxa, although there are many exceptionally polyphagous species. Because weevils and other herbivores have shifted niches among plant parts and plant taxa innumerable times, studies of the rate and direction of change in these different aspects of host use may reveal repeated patterns. These patterns would suggest further lines of inquiry into the possible ecological and genetic bases that could eventually permit synthesis of evolutionary processes among and within species (MARVALDI et al. 2002; OBERPRIELER et al. 2007).

Pest management in cotton requires frequent, labour-intensive, sampling of different age classes of fruit and several species of arthropods. A single, robust, statistical model of dispersion is needed if a simple and efficient programme of sampling all appropriate plant parts and arthropods at each site is to be devised (WILSON et al. 1983).

The fauna of Iranian Curculionidae was poorly studied so far (MODARRES AWAL 1997; BROUMAND 1998; LEGALOV et al. 2010), and in Iranian cotton fields was not studied at all. With attention to the importance of this largest taxon in almost agroecosystems, the fauna of curculionid beetles in Iranian cotton fields and surrounding grasslands is studied in this paper.

Materials and Methods

The specimens were mainly collected by sweeping net and aspirator from different regions of Iran where contain cotton fields. These sampled regions included, Ardabil (Moghan), Chaharmahal & Bakhtiari (Shahrekord), Fars (Darab, Shiraz), Golestan (Gorgan, Gonbad, Azadshahr, Kordkoy, Ali-Abad, Salikandeh, Nokandeh), Khorasan (Kashmar), Mazandaran (Behshahr, Ghaemshahr, Neka, Sari, Galogah), Semnan (Garmsar) and Tehran (Varamin) provinces. In addition to the collected specimen by the authors, several other collected specimens by many researchers and amateur students have also been included in this study. The information concerning the species' name, describer, locality and the date of collection, place/plant on which the species were collected and the number of species (in brackets), are also given. Although the name of the plants on which the specimens collected has been given, this doesn't necessarily mean that they are the host of the species. In this paper, classification and nomenclature of Curculionids suggested by ZHERICHIN & EGOROV (1991), ALONSO-ZARAZAGA & LYAL (1999), COLONNELLI (2003) and VELAZQUEZ DE CASTRO et al. (2007) have been followed.

Results

In a total of 33 species of 9 genera and 4 subfamilies of Curculionidae were collected from Iranian cotton fields and surrounding grasslands. The list of species with their host plants is below.

Subfamily *Curculioninae* LATREILLE 1802

Genus *Ceutorhynchus* GERMAR 1824

Ceutorhynchus fallax BOHEMAN 1845

Material: Mazandaran province: Ghaemshahr (1) on *Abelmoschus esculentus* (Malvaceae), August 2002. Golestan province: Kordkoy (1) in cotton field, September 2003.

Ceutorhynchus sulcatus C. BRISOUTH 1869

Material: Golestan province: Kordkoy (1) on *Hibiscus esculentus* (Malvaceae), unknown date. Fars province: Darab (1) in cotton field, June 2004.

***Ceutorhynchus turbatus* SCHULTZE 1903**

M a t e r i a l : Golestan province: Gonbad (1) in cotton field, July 2003. East Azerbaijan province: Arasbaran (1) in cotton field, July 2005.

Genus *C u r c u l i o* LINNAEUS 1758

***Curculio nucum* LINNAEUS 1758**

M a t e r i a l : Tehran province: Varamin (2) in cotton field, September 2002. Mazandaran province: Behshahr (1) on *Myrtus communis* (Myrtaceae), April 2006.

***Curculio pellitus* BOHEMAN 1843**

M a t e r i a l : Golestan province: Gonbad (1) in cotton field, July 2003. Ardabil province: Moghan in cotton field, July 2004.

***Curculio venosus* (GRAVENHORST 1807)**

M a t e r i a l : East Azerbaijan province: Arasbaran (1) on *Althea officinalis* (Malvaceae), July 2005. Ardabil province: Moghan (1) in cotton field, July 2004.

Genus *T y c h i u s* GERMAR 1817

***Tychius bicolor* CH. BRISOUT 1862**

M a t e r i a l : Semnan province: Garmsar (1) on *Hibiscus trionum* (Malvaceae), September 2005.

***Tychius cuprifer* (PANZER 1799)**

M a t e r i a l : Mazandaran province: Neka (2) on *Rubus odoratus* (Rosaceae), June 2002. Fars province: Darab (2) in cotton field, June 2004. Khorasan province: Kashmar (3) in cotton field, October 2005.

***Tychius festivus* (FAUST 1884)**

M a t e r i a l : East Azarbayjan province: Arasbaran (2) on *Malva parviflora* (Malvaceae), September 2005.

***Tychius medicaginis* CH. BRISOUT 1862**

M a t e r i a l : Golestan province: Gorgan (1) in cotton field, October 2003.

***Tychius pellitus* DESBROCHERS 1908**

M a t e r i a l : Semnan province: Garmsar (1) on *Convolvulus arvensis* (Convolvulaceae), September 2005.

***Tychius ruscicus* DESBROCHERS 1908**

M a t e r i a l : Golestan province: Salikandeh (1) on *Rumex scutatus* (Polygonaceae), August 2003. Golestan province: Minoodasht (1) in cotton field, July 2003.

Subfamily E n t i m i n a e SCHOENHERR 1823

Genus *O t i o r h y n c h u s* (GERMAR 1822)

***Otiorrhynchus (Stupamacus) armicus* FAIRMAIRE 1866**

M a t e r i a l : Golestan province: Ali-Abad (1) in cotton field, July 2003. Semnan province: Garmsar (1) in cotton field, September 2005.

***Otiorrhynchus (Viroprius) asiaticus* STIERLIN 1861**

M a t e r i a l : Fars province: Shiraz (1) on *Hibiscus mutabilis* (Malvaceae), unknown date.

***Otiorrhynchus (Choilisanus) brunneus* KRYNICKI 1834**

M a t e r i a l : Mazandaran province: Sari (2) on *Plantago media* (Plantaginaceae), September 2006.

***Otiorrhynchus (Tournieria) europaeus* STIERLIN 1883**

M a t e r i a l : Golestan province: Gorgan (1) in cotton field, July 2003.

***Otiorrhynchus (Cryphiphorus) ligustici* (LINNAEUS 1758)**

M a t e r i a l : Mazandaran province: Ghaemshahr (1) on *Xanthium spinosum* (Compositae), May 2002. Fars province: Darab (1) in cotton field, June 2004.

Subfamily H y p e r i n a e MARSEUL 1863

Genus *H y p e r a* GERMAR 1817

***Hypera jucundus* CAPIOMONT 1868**

M a t e r i a l : Golestan province: Kordkoy (1) in cotton field, September 2003. Chaharmahal & Bakhtiari province: Shahrekord (1) *Polygonum convolvulus* (Polygonaceae), August 2004.

***Hypera plantaginis* (DE GEER 1775)**

M a t e r i a l : Khorasan province: Kashmar (1) in cotton field, (1) on *Euphorbia geniculata* (Euphorbiaceae), October 2005.

***Hypera trilineata* (MARSHAM 1802)**

M a t e r i a l : Golestan province: Bandar-Torkman (1) in cotton field, August 2003.

Genus *C o n i a t u s* GERMAR 1817

***Coniatus repandus* (FABRICIUS 1792)**

M a t e r i a l : Khorasan province: Kashmar (1) in cotton field, October 2005.

Genus *Donus* JEKEL 1865

***Donus audax* FAUST 1887**

M a t e r i a l : Mazandaran province: Sari (1) on *Cammelia japonica* (Teaceae), October 2002.
Tehran province: Varamin (1) in cotton field, September 2002.

Subfamily *Lixinae* SCHOENHERR 1823

Genus *Larinus* DEJEAN 1821

***Larinus carinirostris* GYLLENHAL 1836**

M a t e r i a l : Chaharmahal & Bakhtiari province: Shahrekord (2) *Polygonum convolvulus* (Polygonaceae), unknown date.

***Larinus griseescens* GYLLENHAL 1836**

M a t e r i a l : Golestan province: Aliabad (1) on *Malva silvestris* (Malvaceae), September 2003.
Ardabil province: Moghan (1) on *Malva parviflora* (Malvaceae), July 2004.

***Larinus minutus* GYLLENHAL 1836**

M a t e r i a l : East Azerbaijan province: Arasbaran (2) in cotton field, September 2005.

***Larinus orientalis* CAPIOMONT 1874**

M a t e r i a l : Semnan province: Garmsar (1) on *Hibiscus syriacus* (Malvaceae), September 2005.

***Larinus rusticanus* GYLLENHAL 1836**

M a t e r i a l : Mazandaran province: Galogah (1) on *Xanthium strumarium* (Compositae), August 2006. Golestan province: Gorgan (1) in cotton field, September 2003.

***Larinus syriacus* GYLLENHAL 1836**

M a t e r i a l : Semnan province: Garmsar (3) on *Malva montana* (Malvaceae), unknown date.

Genus *Lixus* FABRICIUS 1801

***Lixus cardui* OLIVIER 1807**

M a t e r i a l : Golestan province: Kordkoy (1) on *Jasminum fruticans* (Oleaceae), October 2003.
Khorasan province: Kashmar (2) in cotton field, October 2005.

***Lixus elegantulus* BOHEMAN 1843**

M a t e r i a l : Golestan province: Aghghala (1) on *Hibiscus syriacus* (Malvaceae), June 2003.
Golestan province: Azadshahr (1) in cotton field, October 2003.

***Lixus junci* BOHEMAN 1836**

M a t e r i a l : Golestan province: Nokandeh (1) in cotton field, June 2003.

***Lixus punctiventris* BOHEMAN 1836**

M a t e r i a l : Mazandaran province: Behshahr (1) on *Salpichora rhomboidea* (Solanaceae), October 2005.

***Lixus scolapax* BOHEMAN 1836**

M a t e r i a l : Mazandaran province: Behshahr (1) on *Nicotiana tabaccum* (Solanaceae), September 2002. Semnan province: Garmsar (1) in cotton field, unknown date.

Discussion

Biodiversity refers to the variety of life forms at all levels of organization, from the molecular to the landscape level. Biodiversity is generated and maintained in natural ecosystems, where organisms encounter a wide variety of living conditions and chance events that shape their evolution in unique ways. Out of convenience or necessity, biodiversity is usually quantified in terms of numbers of species, and this perspective has greatly influenced conservation goals. It is important to remember, however, that the benefits that biodiversity supplies to humanity are delivered through populations of species residing in living communities within specific physical settings - in other words, through complex ecological systems, or ecosystems (DAILY & EHRlich 1995; GHAHARI et al. 2008; GIACHINO & VAILATI 2010).

Organic cotton has provided significant price premiums for growers willing to meet the many challenges inherent in its production without the aid of conventional pesticides and commercial fertilizers. Growing organic cotton is demanding, but with commitment, experience, and determination, it can be done (MARQUARDT 2002). World production of organic cotton amounts to 6.000 tons of fiber annually, or about 0.03 % of global cotton production. Turkey produces the most at 29 %, with the U.S. being second at 27 % and India third at 17 % (TON 2002). Growing cotton organically entails using cultural practices, natural fertilizers, and biological controls rather than synthetic fertilizers and pesticides. A systems approach to organic production involves the integration of many practices (cover crops, strip cropping, grazing, crop rotation, etc.) into a larger system. Through good soil and biodiversity management, farms can become increasingly self-sufficient in fertility, while pest problems are diminished, and some pests are even controlled outright. A diverse rotation, using legumes and other cover crops, is at the heart of good humus and biodiversity management in an organic cropping system (ALTIERI & LEIBMAN 1986; LAYTON 1996). Cotton fields are one of the agroecosystems which several pests damage to the cotton in different seasons (ROGELIO DIAZ GALARRAGA 2003). The curculionids are one of important and dominant insect groups in cotton fields of almost regions of the world and usually cause significant damage (BROOK et al. 1992; LAYTON 1996; WILLIAMS 1997). Pest management in cotton is a prime example of over-reliance of chemical control of pests, leading to unsustainable cotton production (VAN DEN BOSCH 1978). Due to many problems associated with sole reliance on chemical pest control, cotton pest management has evolved in recent decades to an integrated approach where biological control, cultural control and crop management play crucial roles. Biological control of pests in cotton is mainly exerted by a complex of generalist predators that prevents potential pests from causing economic loss (STERLING et al. 1989).

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Zusammenfassung

Vorliegende Arbeit behandelt die Rüsselkäferfauna (Curculionidae) von iranischen Baumwollfeldern und des umgebenden Grünlandes. 33 Arten aus den Gattungen *Ceutorhynchus*, *Curculio*, *Tychius*, *Hypera*, *Otiorrhynchus*, *Larinus*, *Lixus*, *Coniatus* und *Donus* konnten nachgewiesen werden, ergänzend wurden Angaben zu Futterpflanzen angeführt.

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