

**Faunistic study of the wasps of the subfamilies Poemeniinae and Xoridinae  
(Hym.: Ichneumonidae) in Guilan province**

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**Abstract**

The Hyrcanian forest in the north of Iran is a unique ecoregion in the world with high biodiversity including many endemic Iranian species. The family Ichneumonidae is the largest family of Hymenoptera and one of the most important components and bioindicator of forests. This study was carried out to complete the list of the parasitoid wasps of this family in the Hyrcanian forest. Specimens were collected in Guilan province using Malaise traps and sweep net during 2011-2015. The subfamily Poemeniinae was newly recorded for the Iranian fauna with reporting two species, *Neoxorides collaris* and *N. nitens*. Four species of the subfamily Xoridinae were reported, two of them, *Xorides rufipes* and *X. praecatorius*, were recorded from Iran for the first time. The diagnostic morphological characters and illustrations of these species were provided. Their distribution in the Hyrcanian forest and the Palaearctic as well as their potential important in biological control of forest pests regarding in the possible hosts in Iran were discussed.

**Key words:** Distribution, Hyrcanian forests, parasitoid, taxonomy.

**مطالعه فونستیک زنبورهای زیرخانواده‌های Poemeniinae و Xoridinae (Hym.: Ichneumonidae) در استان گیلان**

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**چکیده**

جنگل‌های هیرکانی در شمال ایران، یکی از زیست بوم‌های منحصر بفرد جهان، با تنوع زیستی بالا و دربرگیرنده بسیاری از گونه‌های اندمیک ایران است. زنبورهای پارازیتوئید خانواده Ichneumonidae بزرگ‌ترین خانواده بال‌غشائیان و یکی از مهم‌ترین اجزای زیست‌بوم جنگل و به عنوان شاخص زیستی شناخته می‌شوند. این مطالعه به منظور تکمیل فهرست زنبورهای این خانواده در جنگل‌های استان گیلان انجام شد. نمونه‌ها بوسیله تله مالیز و تور حشره‌گیری، طی سال‌های ۱۳۹۰-۱۳۹۴ جمع‌آوری شد. از زیرخانواده Poemeniinae دو گونه جدید *Neoxorides collaris* و *N. nitens* برای نخستین بار معرفی شد، همچنین چهار گونه از زیرخانواده Xoridinae شناسایی شدند که دو گونه *Xorides rufipes* و *X. praecatorius* برای اولین بار از ایران گزارش گردیدند. ضمن ارائه ویژگی‌های ریخت‌شناختی افتراقی و توصیف گونه‌ها پراکنش آنها در جنگل‌های هیرکانی و سایر نقاط گزارش شده در ناحیه پالئارکتیک و نیز اهمیت بالقوه آنها در کنترل زیستی با توجه به میزبان‌های احتمالی در ایران بحث شد.

**واژه‌های کلیدی:** پارازیتوئید، پراکنش، تاکسونومی، جنگل‌های هیرکانی.

## Introduction

The family Ichneumonidae is the largest family of the order Hymenoptera with more than 24281 described species worldwide (Yu *et al.*, 2012). The wasps of this family are classified into 7 higher groups and 48 subfamilies based on molecular and morphological characters (Quicke *et al.*, 2009). Almost all ichneumonids are parasitoids of immature stages of holometabolous insects and less commonly eggs and adults of arachnids (Kasparyan, 1981). They affect their hosts in different biological traits and thus regulate the populations of phytophagous insect pests in both, natural and agricultural ecosystems (Wahl and Gauld, 1998; Yu *et al.*, 2012). Ichneumonids are abundant and one of the most important component of woodland forests. They are sensitive to ecological perturbations and have been used as biodiversity indicators in diverse locations (Arnan *et al.*, 2011; Fraser *et al.*, 2007).

So far, there have been recorded 26 subfamilies of the family Ichneumonidae from Iran, 23 of them have been found in the Hyrcanian forests, northern Iran (Barahoei *et al.*, 2012; Hooshyar *et al.*, 2014; Mohammadi-Khoramabadi, 2015a). The Hyrcanian or Caspian ecoregion is a unique and natural place of deciduous forests in the world located in Guilan and Mazandaran provinces comprising 295 plant taxa (Siadati *et al.*, 2013). This area covers biogeographically the southeastern end of the Caucasus hotspot (Sharifi and Javadi, 1971). High annual precipitation (600-2000 mm) and high air humidity make climatologically this area a suitable area for producing a rich and consistent source of food for the trophic levels. Sustainable management of these forests requires adequate basic knowledge on the species composition of parasitoids and their associations (Arnan *et al.*, 2011; Fraser *et al.*, 2007).

The subfamily Xoridinae is a relatively small subfamily with 4 genera and 220 species worldwide (Yu *et al.*, 2012). The vast majority of species belonging to the genus *Xorides* Latreille, 1809 with 157 described species worldwide and 37 species in the Western Palearctic (Varga, 2014; Yu *et al.*, 2012). Xoridines are mainly parasitoids of coleopteran wood-borers of the superfamilies Buprestoidea and Chrysomeloidea (Yu *et al.*, 2012). *Xorides corcyrensis*

*persicator* Aubert, 1971 was the first reported species of this subfamily from Iran which have been reared on the Rosaceae branch borer, *Osphranteria coerulescens* Redtenbacher, 1850 (Col.: Cerambycidae) (Klopfstein and Baur, 2011; Sharifi and Javadi, 1971). Mohammadi-Khoramabadi (2015b) added two other species to the list of Xoridinae of Iran which were collected from Mazandaran province. The Poemeniinae is another small subfamily with 91 described species worldwide, classified into 3 tribes and 11 genera (Yu *et al.*, 2012). There is no any information on the presence of species of this subfamily in Iran.

In order to complete the list of parasitoid wasps of the family Ichneumonidae in the Hyrcanian ecoregion, an ongoing project has been started by the first author in 2011. The main aim of this paper is to provide new data on the two relatively small ichneumonid subfamilies, Poemeniinae and Xoridinae, from the Hyrcanian forests of Iran.

## Materials and Methods

This study is based on the material (19 specimens) collected by the first author using sweep net and four Malaise traps in Guilan province from 2011 to 2015. Identification of species were made using keys and illustrations provided by Oehlke (1966), Townes (1969), Kasparyan (1981), Wahl and Gauld (1998) and Varga (2014). Morphological terminology and general distribution followed Gauld (1991) and Yu *et al.* (2012), respectively. Images were taken using an Olympus SZ60 stereomicroscope equipped with a Canon EOS 600D and were then stacked and edited in Adobe Photoshop CS 5.1. New records for the Iranian fauna are marked with an asterisk (\*). The general distribution of each species was given according to Yu *et al.* (2012). Specimens were deposited in the Insects Collection of College of Agriculture and Natural Resources of Darab, Shiraz University, Darab, Iran.

## Results and Discussion

### Subfamily Poemeniinae Narayanan & Lal 1953\*

**Diagnosis.** Foramen magnum expanded laterally; epomia developed ventrally on a raised surface parallel to anterior margin of pronotum; dorsal surface of hind tibia with

stout spines; metasoma of female with tergite VIII elongate; lower valve of ovipositor enclosed the upper one.

#### The genus *Neoxorides* Clement, 1938\*

**Diagnosis.** Mandible with a single broad tooth (Fig. 1B); clypeus small, flat and subrectangular; eye margins ventrally convergent; frons flat; dorsal half of gena with coarse and distinct denticles (Fig. 2B); epomia absent in dorsal area of collar (Fig. 1C); fore wing with vein 3rs-m completely absent, areolet absent, vein cu-a opposite of vein Cu (Fig. 2C); tarsal claws simple without a basal spatulate bristle; metasoma with tergites II-IV without or with small punctures and with transverse aciculation; last visible tergite of metasoma dorsally convex, projecting beyond end of cercus by about 0.3 x as long as cercus.

#### *Neoxorides collaris* (Gravenhorst, 1829)\* (Fig. 1)

**Material examined.** IRAN, Guilan province, Rudsar County, Rahim Abad, Mayestan Village (36° 45' N, 50° 18' E, 1210 m a.s.l.), 1 ♀, 09 August 2011, sweep netting; Rahim Abad, Lulman forest (36° 52' N, 50° 13' E, 520 m a.s.l.), 1 ♂, 28 June 2011, Malaise trap, leg. A. Mohammadi-Khoramabadi.

**Diagnosis.** Collar of pronotum simple (Fig. 1E); hind coxa red (Fig. 1A, 1C); metasomal tergites II-III quadrate to transverse; ovipositor about 2x as long as hind tibia (Fig. 1A); female with a black face (Fig. 1B); male with a white face (Fig. 1D) and its parameres with a white subapical sclerotized area (Fig. 1F).

**Distribution.** Western Palaearctic: Austria, Belarus, Belgium, Czech Republic, Finland, France, Germany, Hungary, Italy, The Netherlands, Norway, Poland, Romania, Russia, Sweden, Switzerland, Ukraine (Yu *et al.*, 2012) and Iran (new record); Eastern Palaearctic: China and Japan (Yu *et al.*, 2012).

**Hosts.** It has been reported nine Cerambycidae beetle species, and one species of the family Curculionidae associated with *N. collaris* (Yu *et al.*, 2012).

#### *Neoxorides nitens* (Gravenhorst, 1829)\* (Fig. 2)

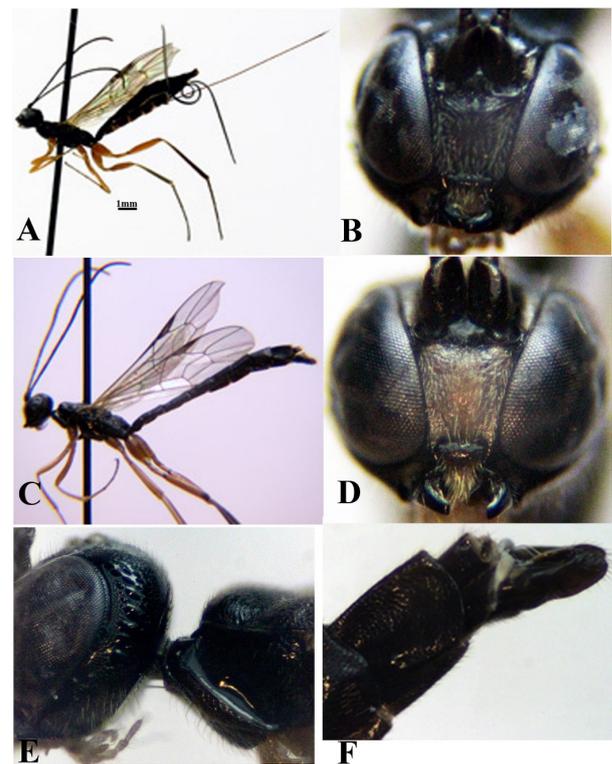
**Material examined.** IRAN, Guilan province, Rudsar county, Rahim Abad, Mayestan Village (36° 45' N, 50° 18' E,

1210 m a.s.l.), 1 ♀, 30 August 2015, sweep netting, leg. A. Mohammadi-Khoramabadi.

**Diagnosis.** This species is very similar to *N. collaris*, but has ridge-like modified collar. Female has a white ocular orbits (Fig. 2B); black coxae (Fig. 2A) and a yellow stripe along epomia (Fig. 2C).

**Distribution.** Western Palaearctic: Albania, Austria, Belarus, Belgium, Bulgaria, Croatia, Czech Republic, Finland, France, Germany, Hungary, Italy, Norway, Poland, Romania, Russia, Sweden, Switzerland, Turkey, United Kingdom (Yu *et al.*, 2012) and Iran (new record); Eastern Palaearctic: Russia - Irkutsk Region (Yu *et al.*, 2012).

**Hosts.** Beetles of the families Buprestidae (one species), Cerambycidae (nine species) and Curculionidae (one species) are reported as hosts of *N. nitens* (Yu *et al.*, 2012).



**Fig. 1.** *Neoxorides collaris*. A) female habitus, B) female face; C) male habitus, D) male face; E) male pronotum; F) male paramere.

#### The subfamily Xoridinae Narayanan & Lal, 1953

**Diagnosis.** Mandible with one (in the genus *Xorides*)

or two teeth (other genera); clypeus convex, small and separated from face; fore wing without an areolet; second recurrent vein with two bullae; hind wing with vein cu-a shorter than vein Cu; propodeum carinated; tarsal claws not pectinate; first metasomal tergite without glymma, fused with its sternite; ovipositor long, without a subapical dorsal notch, its lower valve with ventral apical teeth.

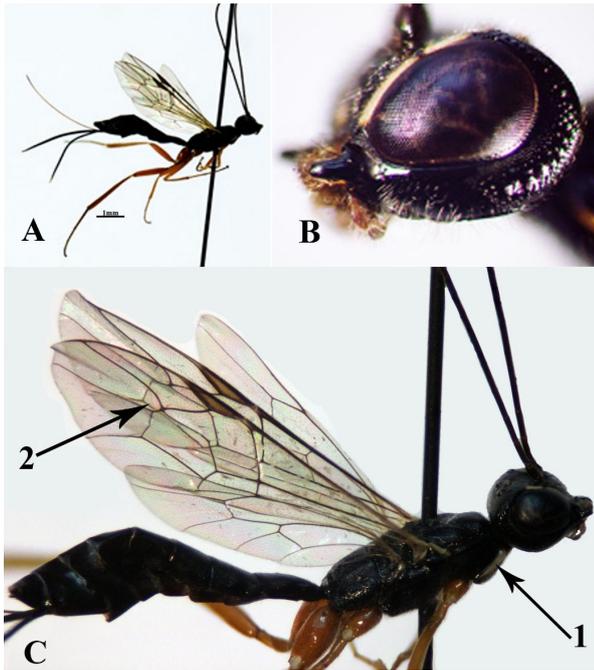


Fig. 2. *Neoxorides nitens* A) female habitus, B) gena, C) body in closer view, arrows show 1- yellow stripe in lower part of pronotum, 2- forewing with vein 3rs-m absent (areolet absent).

**The Genus *Xorides* Latreille, 1809**

**Diagnosis.** Mandible with a single chisel-like tooth, pronotum with long and strong epomia, usually projecting dorsally as a tooth, female antennae curved apically and usually with some peg-like setae at the curved area.

Our specimens are belonging to two subgenera, *Moerophora* and *Xorides*, sensu Townes (1969). The subgenus *Moerophora* can be distinguished from other subgenera by the combination of the following characters: fore wing with vein 1cu-a distad of vein M+Rs (basal vein); fore and mid trochantellus with an acute apical tooth; gena smooth. The subgenus *Xorides* has the following morphological characters: fore wing with vein 1cu-a distad of vein M+Rs (basal vein); fore and mid trochantellus without

an acute apical tooth; gena striated at least ventrally (Kasparyan, 1981; Townes, 1969).

**Key to the known species of the genus *Xorides* from Iran (modified from Townes (1969) and Kasparyan (1981)).**

- 1- Fore wing with vein 1cu-a basad of vein m+Rs (basal vein); mesosternum with posterior transvers carina complete; second trochantellus in lateral view about 2.5 x as long as second trochanter; body with coarse punctures; maxilla with 4<sup>th</sup> segment not shortened (Subgenus *Gonophonus*); metasoma completely black; antenna without a white ring; fore wing without black transverse bands, pterostigma black with a white base .....  
*Xorides (Gonophonus) corcyrensis persicator* Aubert 1976
  - Fore wing with vein 1cu-a distad of vein m+Rs (basal vein) .....2
- 2- Fore and mid trochantellus with an apical acute tooth; gena with punctures, not striated (Fig. 3C); body large and elongated (Fig. 3A); ovipositor sheath longer than the body (Subgenus *Moerophora*); first tergite of metasoma long, strongly narrowed to the base, its apical margin about 2.4 x as wide as its basal edge (Fig. 3D); longitudinal dorsal carinae distinct, reaching beyond the middle of tergite; sclerotized part of first metasomal sternite extending beyond the middle; metasoma black; legs uniformly red (Fig. 3A); pterostigma black, white basally; antenna with white flagellomeres 13–16 (Fig. 3B) .....  
*Xorides (Moerophora) rufipes* (Kriechbaumer 1882)
  - Fore and mid trochantellus without an apical acute tooth; gena striated at least at base (Subgenus *Xorides*) ..... 3
- 3- Metasomal tergites 2-7 with posterolateral white spots (Fig. 5A and E); legs mainly red; hind tibia with a white base (Fig. 5D); Face, eye orbits and gena white (Fig. 5B and 5C); propluron with white stripes around epomia and at dorsal part (Fig. 5C); female with antennal flagellomeres 10, 11 and 12 white (Fig. 5A). .....  
*Xorides (Xorides) praecatorius* (Fabricius 1793)
  - Metasoma uniformly colored, tergites without posterolateral white spots (Fig. 3A and B); hind tibia without white base .....4
- 4- Female with the two preapical antennal flagellomere

transvers, flagellomeres 10-14 white (Fig. 4B and 4F); gena distinctly striated from base to top (Fig. 4E); (legs red, metasoma completely red (Fig. 4B) .....  
*(Xorides) Xorides gravenhorstii* (Curtis 1831)

-- Female with all antennal flagellomeres longer than wide, flagellomeres 9-13 white (Fig. 4A and 4D); gena punctate (Fig. 4B); (all coxae black; hind coxa smooth and shiny; mesosoma black and metasoma red; hind femur entirely red (Fig. 4A) .....  
*Xorides (Xorides) fuligator* (Thunberg 1822)

Four species of the subfamily Xoridinae have been reported from the Hyrcanian forests as follow:

***Xorides rufipes* (Gravenhorst, 1829)\* (Fig. 3)**

**Material examined.** IRAN, Guilan province, Rudsar County, Mayestan village (36° 45' N, 50° 18' E, 1210 m a.s.l.), 1♀, 10 May 2015, sweep netting, leg. A. Mohammadi-Khoramabadi.

**Diagnosis.** First tergite of metasoma long, strongly narrowed to the base, its apical margin about 2.4 x as wide as its basal edge (Fig. 3D); longitudinal dorsal carinae distinct, reaching beyond the middle of tergite; sclerotized part of first metasomal sternite extending beyond the middle; metasoma black; legs uniformly red (Fig. 3A); pterostigma black, white basally; antenna with flagellomeres 13–16 white (Fig. 3B).

**Distribution.** Western Palaearctic: Austria, Azerbaijan, Bosnia and Hercegovina, Bulgaria, Croatia, Czech Republic, Finland, France, Georgia, Germany, Hungary, Italy, Poland, Romania, Russia, Spain, Sweden, Switzerland, Turkey, United Kingdom (Yu *et al.*, 2012) and Iran (new record); Eastern Palaearctic: China (Yu *et al.*, 2012).

**Host.** *Rhagium inquisitor* (Linnaeus, 1758) has been recorded as host of *X. rufipes* (Yu *et al.*, 2012).

***Xorides fuligator* (Thunberg, 1822) (Figs 4A, C, D)**

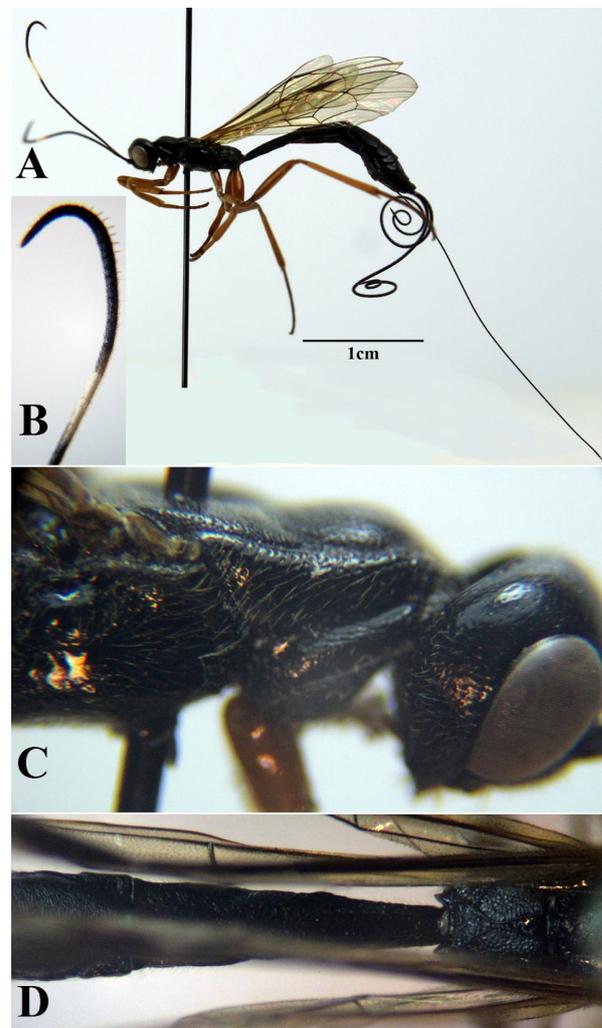
**Material examined.** IRAN, Guilan province, Rudsar County, Mayestan village (36° 45' N, 50° 18' E, 1210 m a.s.l.), 1♀, 06 September 2011, sweep netting, leg. A. Mohammadi-Khoramabadi.

**Diagnosis.** All antennal flagellomeres in female

elongate, flagellomeres 9–13 white (Figs 4A, D); gena punctate (Fig. 4B); all coxae black; hind coxa smooth and shiny; hind femur entirely red (Fig. 4A); mesosoma black and metasoma red.

**Distribution.** Western Palaearctic: Austria, Belarus, Belgium, Bulgaria, Croatia, Czech Republic, Finland, France, Georgia, Germany, Hungary, Ireland, Italy, The Netherlands, Norway, Poland, Romania, Russia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom (Yu *et al.*, 2012) and Iran (Mohammadi-Khoramabadi, 2015b).

**Hosts.** *Xorides fuligator* is known as parasitoid of three species of long-horned beetles of the family Cerambycidae: *Arhopalus rusticus* (L.), *Saperda populnea* (L.) and *S. scalaris* (L.) (Yu *et al.*, 2012).



**Fig. 3.** *Xorides rufipes*, A) female habitus, B) antenna, C) head and mesosoma, D) propodeum and first tergite of metasoma

***Xorides gravenhorstii* (Curtis, 1831) (Figs 4B, E, F)**

**Material examined.** IRAN, Guilan province, Rudsar County, Mayestan village (36° 45' N, 50° 18' E, 1210 m a.s.l.), 1♀ 1♂, 02 September 2011, 2♀♀, 1♂, 12 September 2011, Malaise trap, 26 September 2011, sweep netting; Rahim Abad, Lulman forest (36° 52' N, 50° 13' E, 521 m a.s.l.), 1♀, 25 July 2011, 1♀, 12 September 2011, sweep netting, leg. A. Mohammadi-Khoramabadi.

**Diagnosis.** Two subapical antennal flagellomeres in female transverse, flagellomeres 10–14 white (Figs 4B, F); gena distinctly striated (Fig. 4E); legs red; metasoma completely red (Fig. 4B).

**Distribution.** Western Palaearctic: Algeria, Austria, Azerbaijan, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, France, Georgia, Germany, Greece, Hungary, Ireland, Israel, Italy, Lithuania, The Netherlands, Montenegro, Norway, Poland, Romania, Russia, Serbia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom (Yu *et al.*, 2012) and Iran (Mohammadi-Khoramabadi, 2015b).

**Hosts.** Nine beetle species belonging to the families Anobiidae (two species), Bostrichidae (two species), Chrysomelidae (one species) and Cerambycidae (four species) are known as hosts of *X. gravenhorstii* (Yu *et al.*, 2012).

***Xorides praecatorius* (Fabricius, 1793)\* (Fig. 5)**

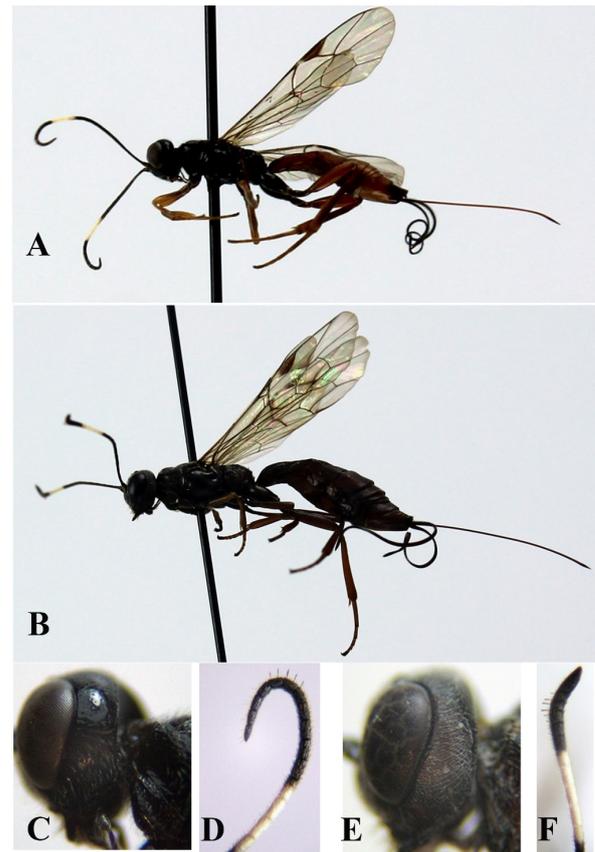
**Material examined.** IRAN, Guilan province, Rudsar County, Mayestan village (36° 45' N, 50° 18' E, 1210 m a.s.l.), 1♀, 15 August 2011, sweep netting, leg. A. Mohammadi-Khoramabadi.

**Diagnosis.** Central metasomal tergites with posterolateral white spots (Figs 5E); hind tibia with a white base (Fig. 5D); face, eye orbits and gena white (Figs 5B, C); pronotum with white stripes around epomia and dorsally (Fig. 5C); female with antennal flagellomeres 10–12 white (Fig. 5A).

**Distribution.** Western Palaearctic: Austria, Belarus, Belgium, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Ireland, Italy, Macedonia, Moldova, Montenegro, The Netherlands, Poland, Romania, Russia, Serbia, Slovakia, Sweden, Switzerland, Turkey,

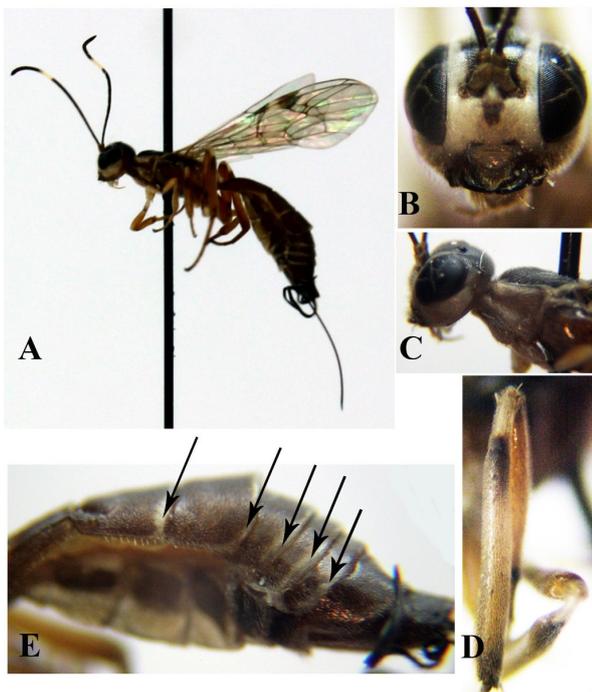
Ukraine, United Kingdom (Yu *et al.*, 2012) and Iran (new record); Eastern Palaearctic: China (Sheng and Wen, 2008).

**Hosts.** There have been reported 27 species as hosts of *X. praecatorius* from Coleoptera: Buprestidae (four species), Chrysomelidae (one species), Cerambycidae (18 species), Curculionidae (one species) (Yu *et al.*, 2012).



**Fig. 4.** *Xorides* spp. *Xorides fuligator*, A) female habitus, C) gena, D) antenna; *Xorides gravenhorstii*, B) female habitus, E) gena, F) antenna.

Our records of the genus *Neoxorides* (Ichneumonidae: Poemeniinae) were found at latitude 36° N in the Hyrcanian forests. The geographical distribution of these two species in the Palaearctic starts from about 35° N to the top. Two other European species of this genus, *N. varipes* and *N. montanus* have yet been occurred from latitude 45° N to the top and thus they are most likely not to be found in the Hyrcanian forests.



**Fig. 5.** *Xorides praecatorius*, A) female habitus, B) face, C) gena and pronotum, D) hind tibia, E) metasoma, arrows show the posterolateral white spots.

All species reported here from two subfamilies, Poemeniinae and Xoridinae, were collected in the elevations from about 500 m to about 1200 m, the submountain and mountain zones of the Hyrcanian forests, where their potential cerambycid hosts are inhabited on the 39 woody perennial trees (Jafari *et al.*, 2013; Siadati *et al.*, 2013). Up to now, 396 species of the family Cerambycidae have been recorded from different parts of Iran (Tavakilian and Chevillotte, 2012). Although some of the long-horned beetles are among the dangerous wood-boring pests of fruit and forest trees in Iran (Radjabi, 2011), but there is not enough data on their biology and their natural enemies of the family Ichneumonidae. Rearing methods will reveal the host parasitoid associations of xoridines and poemenines in the studied area.

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