



Additions to the Iranian fauna of Ichneumonidae (Hymenoptera: Ichneumonoidea) with first records of two genera and 13 species

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ABSTRACT. This paper provides new information on the distribution of 32 species of Ichneumonidae (Hymenoptera: Ichneumonoidea) in Iran. Two genera i.e. *Isadelphus* Forster, 1869 and *Linycus* Cameron, 1903 as well as 13 species i.e. *Casinarina mesozosta* (Gravenhorst, 1829), *Cymodusa antennator* Holmgren, 1860, *Gambrus tricolor* (Gravenhorst, 1829), *Ichneumon inops* Holmgren, 1880, *Idiolispa grossa* (Gravenhorst, 1829), *Isadelphus gallicola* (Bridgman, 1880), *Linycus exhortator* (Fabricius, 1787), *Lissonota buccator* (Thunberg, 1822), *L. carbonaria* Holmgren, 1860, *L. coracina* (Gmelin, 1790), *L. folii* Thomson, 1877, *L. saturator* (Thunberg, 1822), *Therospopus esenbackii* (Gravenhorst, 1829) are newly added to the Iranian wasp fauna.

Key words: Taxonomy, parasitoid, distribution, new record

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Introduction

The family Ichneumonidae is an extremely large, diverse and beneficial group of parasitic wasps with 38 subfamilies and 25285 described species worldwide (Quicke, 2015; Yu et al., 2016). Over the last two decades, the ichneumonid wasp fauna in Iran has received increasing attention and as a result many faunistic studies have been published in the country (Barahoei et al., 2012, 2013, 2014, 2015a, 2015b; Barahoei, 2014; Kazemi et al., 2014; Mohebban et al., 2015, 2016; Sarafi et al., 2015; Mahyabadi et al., 2016; Mohammadi-Khoramabadi et al., 2016; Aghadokht et al., 2017; Amiri et al., 2017; Riedel & Aghadokht, 2017; Etemadi et al., 2018; Shirzadegan et al., 2018; Riedel et al., 2019a). Moreover, a number of new species have been recently described from Iran (Riedel & Aghadokht, 2017; Riedel et al., 2018, 2019a, 2019b).

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The aim of the present study is to improve our knowledge on this diverse group of parasitoid wasps and to provide further information on the fauna of ichneumonid wasps in two provinces, Alborz and Fars of Iran.

Material and methods

Surveys were carried out from March to October 2015 using standard Malaise traps in the provinces of Fars (Southwestern Iran) and Alborz (Northern Iran) in the following six localities. The collecting pot of each trap was filled with ethanol 70% as killing and preservation medium. The captured specimens were removed by an interval of two weeks. The ichneumonid specimens were then dried and pinned or card mounted using AXA method (Van Achterberg, 2009). Identification were made using available illustrations and keys provided for Banchinae (Kasparyan, 1981a) and Campopleginae (Kasparyan, 1981b; Dbar, 1984, 1985; Amiri et al., 2017; Riedel, 2018). Identification of Cryptinae, Ichneumoninae and Tryphoninae species and final confirmation of all species were done by R. Jussila (the fourth author) comparing with specimens in Zoological Museum, Section of Biodiversity and Environmental Sciences, Department of Biology, University of Turku, Finland.

loc. 1. IRAN, Alborz, Arangeh, 35°55' N, 51°04' E, 1800 m, leg. B. M. Jahromi. Arganeh is a small village in the South Alborz Protected Area (Noroozi et al., 2018). The Malaise trap was located in a pear orchard.

loc. 2. IRAN, Alborz, Kordan, Deh Varde, 35°55' N, 50°49' E, 1400 m, leg. B. M. Jahromi. This area also has a mountainous climate similar to Arangeh, but located at a lower altitude. The Malaise trap was situated in a cherry orchard.

loc. 3. IRAN, Fars, Larestan, 27°13' N, 54°25' E, 779 m, leg. A. Falahatpisheh. Larestan is located in the south of Fars province and has a very hot climate, with hot and dry deserts, water shortages and many salt domes. The vegetation includes eucalyptus (*Eucalyptus* spp.), acacia (*Acacia* spp.), jujube (*Ziziphus* spp.) and olive (*Olea* spp.). The pastures are mostly covered with milkvetch (*Astragalus* spp.). The Malaise trap was located in an orange orchard.

loc. 4. IRAN, Fars, Larestan, 27°38' N, 54°16' E, 820 m, leg. A. Falahatpisheh. The Malaise trap was situated in a *Eucalyptus* plantation.

loc. 5. IRAN, Fars, Larestan, Hormood, 27°32' N, 54°59' E, 646 m, leg. A. Falahatpisheh. Hormood is located 100 km to the south of Larestan. Major agricultural crops in this plain are all kinds of vegetable such as tomato, cucumber, eggplant and pumpkin. The Malaise trap was situated in a tomato field.

loc. 6. IRAN, Fars, Larestan, Nime, 27°31' N, 54°26' E, 810 m, leg. A. Falahatpisheh. Nime is located at 15 to 20 km to the south-east of Larestan. There are agricultural crops such as wheat, barley, canola, alfalfa, and citrus orchards in this plain. The Malaise trap was located in an alfalfa field.

Voucher specimens are deposited at insect collection of college of Agriculture and Natural Resources of Darab, Shiraz University and private collection of Dr. R. Jussila at University of Turku, Finland. Nomenclature, classification and general distribution were adapted from Yu et al. (2016).

Results

In total, 32 species belonging to five subfamilies: Banchinae (seven species of two genera), Campopleginae (seven species of seven genera), Cryptinae (ten species of nine genera), Ichneumoninae (seven species of five genera) and Tryphoninae (one species of one genus) were collected and identified. Two genera and 13 species are newly recorded for the fauna of Iran, indicated by two (**) and one asterisks (*), respectively. The species are listed alphabetically.

I. Banchinae Wesmael, 1845

Exetastes adpressorius (Thunberg, 1822)

Material examined: Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 29.III.2015–9.IV.2015.

Distribution in Iran: Fars and Kerman provinces (Sarafi et al., 2015; Mohebban et al., 2016).

General distribution: Holarctic.

Lissonota buccator (Thunberg, 1822)*

Material examined: Iran, Alborz province, Arangeh, 1♀, 13–27.IX.2015; Fars province, Larestan, 1♀, 25.IV.2015–7.V.2015.

Distribution in Iran: Alborz and Fars provinces (new record for Iran).

General distribution: Western Palaearctic.

Lissonota carbonaria Holmgren, 1860*

Material examined: Iran, Fars province, Larestan, 1♀, 12–26.VII.2015.

Distribution in Iran: Fars province (new record for Iran).

General distribution: Palaearctic.

Lissonota clypeator (Gravenhorst, 1829)

Material examined: Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 6–20.VIII.2015.

Distribution in Iran: Fars province (Amiri et al., 2016), Kerman (Mohebban et al., 2016) and Alborz provinces (Current study).

General distribution: Holarctic.

Lissonota coracina (Gmelin, 1790)*

Material examined: Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 6–20.VIII.2015.

Distribution in Iran: Alborz province (new record for Iran).

General distribution: Holarctic.

Lissonota folii Thomson, 1877*

Material examined: Iran, Alborz province, Kordan, Deh Varde, 1♀, 6–20.VIII.2015.

Distribution in Iran: Alborz province (new record for Iran).

General distribution: Holarctic.

Lissonota saturator (Thunberg, 1822)*

Material examined: Iran, Fars province, Larestan, 1♀, 29.III.2015–9.IV.2015.

Distribution in Iran: Fars province (**new record for Iran**).

General distribution: Palaearctic.

II. Campopleginae Förster, 1869

Casinaria mesozosta (Gravenhorst, 1829)*

Material examined: Iran, Fars province, Larestan, 2♀♀, 25.IV.2015–7.V.2015.

Distribution in Iran: Fars province (**new record for Iran**).

General distribution: Western Palaearctic.

Campoplex multicoloratus Gravenhorst, 1829

Material examined: Iran, Fars province, Larestan, 2♀♀, 23.IX.2015–5.X.2015

Distribution in Iran: Tehran (Masnadi-Yazdinejad et al., 2010) and Fars provinces (Current study).

General distribution: Palaearctic, Oriental and Nearctic (Introduced into U.S.A.).

Cymodusa antennator Holmgren, 1860 *

Material examined: Iran, Fars province, Larestan, 1♀, 25.IV.2015–7.V.2015; Alborz province, Kordan, Deh Varde, 1♀, 6–20.VIII.2015.

Distribution in Iran: Fars and Alborz provinces (**new record for Iran**).

General distribution: Palaearctic, Oriental and Afrotropical (Introduced into South Africa).

Diadegma anurum (Thomson, 1887)

Material examined: Iran, Fars province, Larestan, 2♀♀, 25.IV.2015–7.V.2015.

Distribution in Iran: [Reported through a misidentification from Alborz province by Golizadeh et al. (2008) but corrected by Karimzadeh & Broad (2013)]; Golestan (Masnadi-YazdiNejad et al., 2010) and Fars provinces (Current Study).

General distribution: Palaearctic.

Diadegma fenestrata (Holmgren, 1860)

Material examined: Iran, Fars province, Larestan, 2♀♀, 25.IV.2015–7.V.2015.

Distribution in Iran: Fars province (Masnadi-YazdiNejad, 2006).

General distribution: Palaearctic, Oriental, Oceanic.

Hyposoter leucomerus (Thomson, 1887)

Material examined: Iran, Fars province, Larestan, 1♀, 29.III.2015–9.IV.2015, 2♀♀, 23.IX.2015–5.X.2015.

Distribution in Iran: Tehran (Hasanshahi et al., 2015c) and Fars provinces (Current Study).

General distribution: Western Palaearctic.

***Venturia canescens* (Gravenhorst, 1829)**

Material examined: Iran, Fars province, Larestan, 2♀♀, 5–12.X.2015.

Distribution in Iran: Guilan, Kerman, Khorasan-e-Razavi and Fars provinces (Barahoei et al., 2012).

General distribution: Afrotropical, Australian, Holarctic, Neotropical, Oceanic, Oriental.

III. Cryptinae Kirby, 1837***Cryptus armator* (Fabricius, 1804)**

Material examined: Iran, Alborz province, Kordan, Deh Varde, 3♀♀, 6–20.VIII.2015

Distribution in Iran: Kerman (Mohebban et al., 2016) and Alborz province (Current study).

General distribution: Palaearctic.

***Dichrogaster perlae* (Doumerec, 1855)**

Material examined: Iran, Fars province, Larestan, 1♀, 29.III.2015–9.VI.2015; Alborz province, Arangeh, 1♀, 13–27.IX.2015.

Distribution in Iran: Fars (Etemadi et al., 2018) and Alborz provinces (Current study).

General distribution: Western Palaearctic.

Gambrus tricolor* (Gravenhorst, 1829)

Material examined: Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 6–20.VIII.2015; Arangeh, 1♀, 13–27.IX.2015; Fars province, Larestan, 1♀, 12–26.VII.2015.

Distribution in Iran: Alborz and Fars provinces (**new record for Iran**).

General distribution: Western Palaearctic.

Idiolispa grossa* (Gravenhorst, 1829)

Material examined: Iran, Alborz province, Kordan, Deh Varde, 1♀, 29.III.2015–9.IV.2015, 4♀♀, 6–20.VIII.2015; Fars province, Larestan, 1♀, 25.IV.2015–7.V.2015

Distribution in Iran: Alborz and Fars provinces (**new record for Iran**).

General distribution: Palaearctic.

Isadelphus gallicola* (Bridgman, 1880)*

Material examined: Iran, Fars province, Larestan, 1♀, 23.V.2015–6.VI.2015.

Distribution in Iran: Fars province (**new record for Iran**). The genus is newly recorded from Iran.

General distribution: Western Palaearctic.

***Meringopus pseudonymus* (Tschek, 1878)**

Material examined: Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 6–20.VIII.2015.

Distribution in Iran: West Azarbaijan, Lorestan (Barahoei et al., 2012) and Alborz provinces (Current study).

General distribution: Palaearctic.

***Mesostenus grammicus* Gravenhorst, 1829**

Material examined: Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 29.III.2015– 9.IV.2015, 3♀♀, 12–20.VI.2015, 1♀, 6–20.VIII.2015; Fars province, Larestan, 1♀, 29.III.2015–9.IV.2015, 2♀♀, 25.IV.2015–7.V.2015.

Distribution in Iran: Fars, Kerman (Mahyabadi et al., 2016) and Alborz provinces (current study).

General distribution: Palaearctic.

Theroscopus esenbeckii* (Gravenhorst, 1829)

Material examined: Iran, Fars province, Larestan, 1♀, 29.III.2015–9.IV.2015, 2♀♀, 23.V.2015–6.VI.2015.

Distribution in Iran: Fars province (new record for Iran).

General distribution: Western Palaearctic.

***Trychosis legator* (Thunberg, 1824)**

Material examined: Iran, Fars province, Larestan, 3♀♀, 29.III.2015–9.IV.2015; Alborz province, Kordan, Deh Varde, 2♀♀, 6–20.VIII.2015.

Distribution in Iran: Fars, Kerman, Sistan and Baluchestan, West Azarbaijan, Khorasan-e Razavi, Qazvin (Mahyabadi et al., 2016) and Alborz provinces (Current study).

General distribution: Western Palaearctic.

***Trychosis tristator* (Thomson, 1871)**

Material examined: Iran, Fars province, Larestan, 1♀, 29.III.2015–9.IV.2015.

Distribution in Iran: West Azarbaijan (Mahyabadi et al., 2016) and Fars provinces (Current study).

General distribution: Palaearctic.

IV. Ichneumoninae Latreille, 1802***Barichneumon derogator* (Wesmael, 1845)**

Material examined: Iran, Fars province, Larestan, 2♀♀, 29.III.2015–9.IV.2015;

Distribution in Iran: Kerman (Mohebban et al., 2015) and Fars provinces (Current study).

General distribution: Palaearctic.

***Ctenichneumon devyldeeri* (Holmgren, 1871)**

Material examined: Iran, Alborz province, Kordan, Deh Varde, 3♀♀, 6–20.VIII.2015.

Distribution in Iran: Qom (Masnadi-Yazdinejad & Jussila, 2008), Kerman (Mohebban et al., 2015) and Alborz provinces (Current study).

General distribution: Palaearctic.

Ichneumon inops Holmgren, 1880*

Material examined: Iran, Alborz province, Kordan, Deh Varde, 1♀, 6–20.VIII.2015.

Distribution in Iran: Alborz province (**new record for Iran**).

General distribution: Palaearctic.

Ichneumon melanosomus Wesmael, 1855

Material examined: Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 6–20.VIII.2015.

Distribution in Iran: West Azerbaijan (Barahoei et al., 2012) and Alborz provinces (Current study).

General distribution: Western Palaearctic.

Ichneumon sarcitorius caucasicus Meyer, 1926

Material examined: Iran, Alborz province, Arangeh, 2♀♀, 13–27.IX.2015.

Distribution in Iran: Northern Khorasan, Kerman (Mohebban et al., 2017) and Alborz provinces (Current study).

General distribution: Western Palaearctic, Oceanic.

Linyctus exhortator (Fabricius, 1787)**

Material examined: Iran, Fars province, Larestan, 1♀, 29.III.2015–9.IV.2015; Alborz province, Arangeh, 1♀, 13–27.IX.2015.

Distribution in Iran: Fars and Alborz provinces (**new record for Iran**). The genus is newly recorded from Iran.

General distribution: Holarctic.

Probolus concinnus Wesmael, 1853

Material examined: Iran, Alborz province, Kordan, Deh Varde, 2♀♀, 6–20.VIII.2015.

Distribution in Iran: East Azerbaijan (Barahoei et al., 2012) and Alborz provinces (Current study).

General distribution: Palaearctic.

V. Tryphoninae Shuckard, 1840

Netelia semenowi (Kokujev, 1899)

Material examined: Iran, Alborz province, Kordan, Deh Varde, 3♀♀, 6–20.VIII.2015.

Distribution in Iran: Not exactly defined (Barahoei et al., 2012); Alborz province (Current study).

General distribution: Palaearctic.

Discussion

Here, we present new distributional data for 32 Ichneumonid species collected during the year 2015 in two provinces Alborz and Fars. Two genera and 13 species are newly added to the Iranian wasp fauna. With this publication and other recently published data in 2019

(Mohammadi-Khoramabadi et al., 2020; Riedel et al., 2019a), the number of some Iranian Ichneumonid subfamilies (e.g. 216 Ichneumoninae species) corresponds to some rather well-studied neighboring countries, e.g. Turkey with 218 ichneumoninae species (Yu et al., 2016). Now, the number of Iranian Banchinae, Ichneumoninae and Cryptinae increased to 27, 216 and 138 species, respectively (Barahoei et al., 2012; Amiri et al., 2016; Mahyabadi et al., 2016; Mohammadi-Khoramabadi et al., 2016; Riedel & Aghadokht, 2017; Shirzadegan et al., 2018; Riedel et al., 2019a). But, the presence of a large new records in this study and the recent publication of (Riedel et al. (2019a)) may indicate that the Iranian Ichneumoidae not thoroughly explored yet.

Table 1. The adult flight period of the current known ichmeumonids during 2015 in Iran.

Species	III	IV	V	VI	VII	VIII	IX	X
<i>Exetastes adpressorius</i>		■	■					
<i>Lissonota buccator</i>			■	■			■	■
<i>Lissonota carbonaria</i>					■	■		
<i>Lissonota clypeator</i>						■	■	
<i>Lissonota coracina</i>						■	■	
<i>Lissonota folii</i>						■	■	
<i>Lissonota saturator</i>		■	■					
<i>Casinaria mesozosta</i>			■	■				
<i>Campoplex multicolor</i>							■	■
<i>Cymodusa antennator</i>			■	■		■	■	
<i>Diadegma anurum</i>			■	■				
<i>Diadegma fenestrata</i>			■	■				
<i>Hyposoter leucomerus</i>			■	■			■	■
<i>Venturia canescens</i>							■	■
<i>Cryptus armator</i>						■	■	
<i>Dichrogaster perlae</i>		■	■				■	■
<i>Gambrus tricolor</i>					■	■	■	■
<i>Idiolispa grossa</i>		■	■	■	■	■		
<i>Isadelphus gallicola</i>				■	■			
<i>Meringopus pseudonymus</i>						■	■	
<i>Mesostenus grammicus</i>		■	■	■	■	■	■	
<i>Theriscopis esenbeckii</i>		■	■			■	■	
<i>Trypoxys legator</i>		■	■			■	■	
<i>Trypoxys tristator</i>		■	■					
<i>Barichneumon derogator</i>		■	■					
<i>Ctenichneumon devylderii</i>						■	■	
<i>Ichneumon inops</i>						■	■	
<i>Ichneumon melanosomus</i>						■	■	
<i>Ichneumon sarcitorius</i>							■	■
<i>Linycus exhortator</i>		■	■				■	■
<i>Probolus concinnus</i>						■	■	
<i>Netelia semenowi</i>						■	■	

Most of the species collected in the current study restricted to the Palaearctic region (26 species, 81.26%), whereas only a single species (3.12%) distributed in all biogeographic areas and is a cosmopolitan species. Moreover, four species (12.5%) are distributed in the Holarctic region, while a slight overlap with the fauna of the Oriental region (a single species, 3.12%).

The host range of the current ichneumonid wasps is highly variable, some attacking a wide variety (i.e. *E. adpressorius*, *L. buccator*, *L. carbonaria*, *L. clypeator*, *L. coracina*, *L. folii*, *L. saturator*, *C. multicinctus*, *D. fenestrata*, *V. canescens*, *G. tricolor*, *I. gallicola*, *M. grammicus*, *T. esenbeckii*, *I. sarcitorius*) and others being specialized to one (i.e. *M. pseudonymus*) or a few host species (i.e. *C. mesozosta*, *C. Antennator*, *D. anurum*, *H. leucomerus*, *C. armator*, *D. perlae*, *T. legator*, *T. tristator*, *B. derogator*, *L. exhortator*). They attack hosts in the orders Lepidoptera (i.e. *E. adpressorius*, *L. buccator*, *L. carbonaria*, *L. clypeator*, *L. coracina*, *L. folii*, *L. saturator*, *C. mesozosta*, *C. multicinctus*, *C. antennator*, *D. anurum*, *D. fenestrata*, *H. leucomerus*, *V. canescens*, *C. armator*, *G. tricolor*, *I. gallicola*, *M. pseudonymus*, *M. grammicus*, *T. esenbeckii*, *T. legator*, *B. derogator*, *I. sarcitorius*, *L. exhortator*), Hymenoptera (i.e. *G. tricolor*, *I. gallicola*, *T. esenbeckii*), Diptera (i.e. *L. buccator*, *D. fenestrata*) Coleoptera (i.e. *L. buccator*, *D. anurum*, *D. fenestrata*, *I. gallicola*), Neuroptera (i.e. *D. perlae*), as well as spiders and spider egg sacs (*T. legator*, *T. tristator*) (Quicke, 2015; Yu et al., 2016). In biological control perspective of important agricultural pests and because of high reproductive capacity and ease of mass rearing, the performance of *V. canescens* has been recently determined on five resistant cultivars of pomegranate as a promising biological control agent of the carob moth, *Apomyelois ceratoniae* Zeller, 1839 (Lep.: Pyralidae) in Iran (Kishani-Farahani et al., 2012; Abedi et al., 2020). Some species, i.e. *H. leucomerus* may affect their host pest populations to some lower degree in a parasitoids complex (Razmi et al., 2011; Hasanshahi et al., 2015a, 2015b, 2015c). On the other hand, species of the genera *Dichrogaster* (i.e. *D. perlae*) and *Trychosis* (i.e. *T. legator* and *T. tristator*) negatively affect the predator populations of Neuroptera and spiders (Yu et al., 2016). As Malaise traps were used for collecting in the current study, no conclusions on biological traits such as host specificity can be made. Therefore, an intensive collection and further studies on the distribution, systematics, behavior and biology should be supported.

The adult flight period of the known ichneumonids in this study show some differences (Table 1). Seven species, i.e. *L. buccator*, *C. antennator*, *D. perlae*, *G. tricolor*, *I. grossa*, *M. grammicus* and *T. legator* which were found both in the southwest (Larestan, Fars province) and in the north (Alborz province) of Iran, and *H. leucomerus*, *T. esenbeckii* and *L. exhortator* which were captured only in Larestan (southwest of Iran) showed two periods of appearance. The rest appeared in one period (Table 1) but cannot completely reflect their annual flight period in their habitat.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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اطلاعات جدید از فون زنبورهای خانواده Ichneumonidae (Hymenoptera: Ichneumonoidea) ایران با گزارش دو جنس و سیزده گونه جدید

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چکیده: این مقاله، اطلاعات جدیدی از پراکنش ۳۲ گونه از زنبورهای خانواده Ichneumonidae (Hymenoptera: Ichneumonoidea) در ایران فراهم نموده است. دو جنس *Isadelphus* Forster, 1869 و *Linytus* Cameron, 1903 به همراه ۱۳ گونه به نام‌های *Cymodusa Casinaria mesozosta* (Gravenhorst, 1829)، *Gambrus tricolor antennator* Holmgren, 1860، *Jdiolispa grossa* (Gravenhorst, 1829)، *Ichneumon inops* Holmgren, 1880، *Linytus exhortator* (Fabricius)، *Isadelphus gallicola* (Bridgman, 1880)، *L. carbonaria* Holmgren، *Lissonota buccator* (Thunberg, 1822)، 1787، *L. saturator*، *L. folii* Thomson, 1877، *L. coracina* (Gmelin, 1790)، 1860، *Theroscopus esenbeckii* (Gravenhorst, 1829) و (Thunberg, 1822) به فون زنبورهای ایران اضافه شدند.

واژگان کلیدی: طبقه‌بندی، پارازیتوئید، پراکنش، گزارش جدید