

Checklist of Himalayan Alysiinae (Hymenoptera: Braconidae)

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Abstract

A checklist of Alysiinae from the Himalayan region is provided, including 58 species of 17 genera, *Alysia* Latreille, 1804, *Alysiasta* Wharton, 1980, *Aspilota* Foerster, 1863, *Chorebus* Haliday, 1833, *Coelinidea* Viereck, 1913, *Cratospila* Foerster, 1863, *Dacnusa* Haliday, 1833, *Dapsilarthra* Foerster, 1863, *Dinotrema* Foerster, 1863, *Eurymeros* Bhat, 1980, *Heratemis* Walker, 1860, *Idiasta* Foerster, 1863, *Leptotrema* van Achterberg, 1988, *Mesocrina* Foerster, 1863, *Orthostigma* Ratzeburg, 1844, *Phaenocarpa* Foerster, 1863, and *Rhacalsysia* Cameron, 1910 belonging to two tribes, Alysiini Leach, 1815 and Dacnusini Foerster, 1863.

Zusammenfassung

Es wird eine Checkliste der Braconidae-Unterfamilie Alysiinae der Himalayaregion vorgestellt, die 58 Arten aus den folgenden 17 Gattungen enthält: *Alysia* Latreille, 1804, *Alysiasta* Wharton, 1980, *Aspilota* Foerster, 1863, *Chorebus* Haliday, 1833, *Coelinidea* Viereck, 1913, *Cratospila* Foerster, 1863, *Dacnusa* Haliday, 1833, *Dapsilarthra* Foerster, 1863, *Dinotrema* Foerster, 1863, *Eurymeros* Bhat, 1980, *Heratemis* Walker, 1860, *Idiasta* Foerster, 1863, *Leptotrema* van Achterberg, 1988, *Mesocrina* Foerster, 1863, *Orthostigma* Ratzeburg, 1844, *Phaenocarpa* Foerster, 1863, und *Rhacalsysia* Cameron, 1910, die zu den Tribus Alysiini Leach, 1815 und Dacnusini Foerster, 1863 gehören.

Key words: Braconidae, parasitoid of Diptera, Himalayan region, checklist

Introduction

The Himalayan mountains are considered as one of the world's main biodiversity hotspots (MYERS et al. 2000) and run from west-northwest to east-southeast in an arc 2400 km long (WADIA 1931). The region supports rich biodiversity, from tropical rainforests to alpine shrubs (AZAD THAKUR et al. 2012). The accelerated pace of environmental deterioration and the associated loss of whole taxonomic groups (MAYR 1992, HAWKS-WORTH & RITCHIE 1993, WILSON 1994) underlines the critical importance of biodiversity studies to gain a deeper knowledge of the ecosystems and to implement measures that ensure the conservation of biodiversity and the maintenance of forested reserves (PYLE et al. 1981; PEARSON & CASSOLA 1992, KREMEN et al. 1993). The study of insects, which have a high sensitivity to alterations in environmental resources and conditions, is particularly important.

Parasitoid Hymenoptera of the family Braconidae, with around 15,000 catalogued species, are especially pertinent in this respect due to their biology (WHARTON et al. 1997) and are a valid parameter to determine human effects on these communities, and for assessment of specific diversity within a region (GONZÁLEZ & RUÍZ 2000).

Braconidae are the second largest family within Hymenoptera, the majority of species are primary parasitoids of immature stages of Lepidoptera, Coleoptera and Diptera (SHARKEY 1993). Within Braconidae, Alysiinae is a large subfamily of koinobiont endoparasitoids of Cyclorrhapha-Diptera (WHARTON et al. 1997) and has enormous agricultural, ecological and economical importance because of their role in controlling phytophagous species, having direct effects on the size of host populations and indirect effects on the diversity and survival of the host plants (LASALLE & GAULD 1993, GONZÁLEZ & RUÍZ 2000, PERIS-FELIPO et al. 2014).

A total of 107 genera and about 2450 species of the subfamily Alysiinae have been described worldwide (PERIS-FELIPO et al. 2014, YU et al. 2016). Alysiinae species can be well recognised by the shape and position of the exodont mandibles (in which the mandibles do not touch each other even when closed (VAN ACHTERBERG 1993, BELOKOBILSKIJ & KOSTROMINA 2011).

The subfamily is divided into two large and polymorphic tribes, Alysiini and Dacnusini (SHENEFELT 1974; PERIS-FELIPO et al. 2014). Morphologically, these two tribes are mainly distinguished by the presence (Alysiini) or absence (Dacnusini) of the fore wing vein r-m (second radiomedial); according Alysiini has three submarginal (radiomedial) cells while Dacnusini have only two (PERIS-FELIPO et al. 2014). Dacnusini members are parasitoids of leaf and stem mining dipterans, especially those of the family Agromyzidae; while those of the tribe Alysiini are recorded to attack a wide range of dipteran hosts from at least 20 families (more common Agromyzidae, Phoridae, Ephydriidae, Chloropidae, Calliphoridae and Anthomyiidae) (BELOKOBILSKIJ 2005; FISCHER & BEYARSLAN 2012).

Several studies have been conducted on Alysiinae from Himalayan countries, mainly carried out by BHAT (1978a, b, 1979a, b, c, 1980a, b). However, no comprehensive studies have been conducted in the area since the 1980s. The present work compiles for the first time the Himalayan Alysiinae species.

Materials and methods

The published data on the subfamily Alysiinae from the Himalaya are summarized. Classification of the different taxa follows YU et al. (2016), or references to other works are given. Names of valid genera are listed alphabetically within tribes, and valid species names are listed alphabetically within genera.

Results

A total of 58 species belonging to the 17 genera, *Alysia* Latreille, 1804, *Alysiasta* Wharton, 1980, *Aspilota* Foerster, 1863, *Chorebus* Haliday, 1833, *Coelinidea* Viereck, 1913, *Cratospila* Foerster, 1863, *Dacnusa* Haliday, 1833, *Dapsilarthra* Foerster, 1863, *Dinotrema* Foerster, 1863, *Eurymeros* Bhat, 1980, *Heratemis* Walker, 1860, *Idiasta* Foerster, 1863, *Leptotrema* van Achterberg, 1988, *Mesocrina* Foerster, 1863, *Orthostigma*

Ratzeburg, 1844, *Phaenocarpa* Foerster, 1863, and *Rhacalyisia* Cameron, 1910 are catalogued for the Himalayan region.

Class Hexapoda Blainville, 1816

Order Hymenoptera Linnaeus, 1758

Family Braconidae Nees, 1811

Subfamily Alysiinae Leach, 1815

Tribe Alysiini Leach, 1815

Alyisia (Alyisia) shangrila Wharton, 1986

Himalayan distribution: Kathmandu (Nepal) (WHARTON 1986).

General distribution: Malaysia and Nepal.

Alysiasta abbreviata (Bhat, 1979)

Himalayan distribution: Sikkim (India) (BHAT 1979a).

General distribution: India.

Alysiasta sikkimensis (Bhat, 1979)

Himalayan distribution: Sikkim (India) (BHAT 1979a).

General distribution: India.

Aspilota (Aspilota) brunnea Bhat, 1979

Himalayan distribution: Jammu and Kashmir and West Bengal (India) (BHAT 1979b, FISCHER 2012).

General distribution: India.

Aspilota (Aspilota) cubitalaris Sharma, 1978

Himalayan distribution: Himachal Pradesh (India) and Phulchowki (Nepal) (BHAT 1979b).

General distribution: India.

Aspilota (Aspilota) ferruginea Sharma, 1978

Himalayan distribution: Kambaiti (Myanmar) (BHAT 1979b).

General distribution: Myanmar.

Aspilota (Eusynaldis) gigascapus (Fischer, 1993)

Himalayan distribution: West Bengal (India) (FISCHER 1993a).

General distribution: India.

Aspilota (Aspilota) indica Bhat, 1979

Himalayan distribution: Himachal Pradesh (India) (BHAT 1979b).

General distribution: India.

Aspilota (Aspilota) longiflagellata Bhat, 1979

Himalayan distribution: Himachal Pradesh (India) (BHAT 1979b).

General distribution: India.

Aspilota (Aspilota) poonchensis Fischer, 2012

Himalayan distribution: Jammu and Kashmir (India) (FISCHER 2012).

General distribution: India.

Aspilota (Aspilota) sikkimensis Bhat, 1979

Himalayan distribution: Sikkim (India) (BHAT 1979b).

General distribution: India.

Cratospila bhutanensis Bhat, 1980

Himalayan distribution: Thimpu (Bhutan) (BHAT 1980a).

General distribution: Bhutan and Malaysia.

Cratospila curvabilis Bhat, 1980

Himalayan distribution: Himachal Pradesh (India) (BHAT 1980a).

General distribution: India.

Cratospila longicornis Szepligeti, 1905

Himalayan distribution: Himachal Pradesh (India) (BHAT 1980a).

General distribution: India, Malaysia and Singapore.

Dapsilarthra antisulcata (Bhat, 1979)

Himalayan distribution: Himachal Pradesh (India) (FISCHER, 1993b).

General distribution: India.

Dapsilarthra ferruginea Bhat, 1979

Himalayan distribution: Himachal Pradesh (India) (FISCHER 1993b).

General distribution: India.

Dapsilarthra himachali Bhat, 1979

Himalayan distribution: Himachal Pradesh (India) (BHAT 1979c).

General distribution: India.

Dapsilarthra kashmirensis Bhat, 1979

Himalayan distribution: Jammu and Kashmir (India) (BHAT 1979c).

General distribution: India.

Dinotrema (Dinotrema) behdalaense Fischer, 2012

Himalayan distribution: Himachal Pradesh and Jammu and Kashmir (India) (FISCHER 2012).

General distribution: India.

Dinotrema (Dinotrema) bengalense (Bhat, 1979)

Himalayan distribution: West Bengal (India) (BHAT, 1979b).

General distribution: India.

Dinotrema (Dinotrema) bhutanense (Bhat, 1979)

Himalayan distribution: Thimpu (Bhutan) (BHAT 1979b).

General distribution: Bhutan.

Dinotrema (Dinotrema) himachali (Bhat, 1979)

Himalayan distribution: Himachal Pradesh (India) (BHAT 1979b).

General distribution: India.

Dinotrema (Dinotrema) kaleambense Fischer, 2012

Himalayan distribution: Himachal Pradesh (India) (FISCHER 2012).

General distribution: India.

Dinotrema (Dinotrema) magnum (Bhat, 1979)

Himalayan distribution: Himachal Pradesh (India) (BHAT 1979b).

General distribution: India.

Dinotrema (Dinotrema) marshi (Bhat, 1979)

Himalayan distribution: Himachal Pradesh and West Bengal (India) (BHAT 1979b).

General distribution: India.

Dinotrema (Dinotrema) minutum (Bhat, 1979)

Himalayan distribution: Himachal Pradesh (India) (BHAT 1979b).

General distribution: India.

Dinotrema (Dinotrema) nigrum (Bhat, 1979)

Himalayan distribution: West Bengal (India) (BHAT 1979b).

General distribution: India.

Dinotrema (Dinotrema) sandaracum (Bhat, 1979)

Himalayan distribution: Himachal Pradesh (India) (BHAT 1979b).

General distribution: India.

Eurymeros tumespiraculum Bhat, 1980

Himalayan distribution: Himachal Pradesh (India) (BHAT 1980b).

General distribution: India.

Heratemis nepalicola (Fischer, 2006)

Himalayan distribution: Kosi (Nepal) (FISCHER 2006).

General distribution: Nepal.

Idiasta minor Bhat, 1979

Himalayan distribution: Himachal Pradesh (India) (BHAT 1978a).

General distribution: India.

Idiasta nigra Bhat, 1979

Himalayan distribution: Himachal Pradesh and West Bengal (India) (BHAT 1978a).

General distribution: India.

Idiasta nigriae (Sharma, 1978)

Himalayan distribution: Himachal Pradesh (India) (BHAT 1978b).

General distribution: India.

Idiasta superficialis (Bhat, 1979)

Himalayan distribution: West Bengal (India) (BHAT 1979a).

General distribution: India.

Idiasta totinigra Fischer, 2008

Himalayan distribution: Jammu and Kashmir (India) (FISCHER 2012).

General distribution: India.

Leptotrema bovefemora (Bhat, 1979)

Himalayan distribution: Himachal Pradesh (India) (BHAT 1979b).

General distribution: India.

Mesocrina dalhousiensis (Sharma, 1978)

Himalayan distribution: Himachal Pradesh (India) (BHAT 1978b).

General distribution: China and India.

Orthostigma kathmanduense Fischer, 1995

Himalayan distribution: Kathmandu (Nepal) (FISCHER 1995).

General distribution: Nepal.

Orthostigma nepalense Fischer, 1995

Himalayan distribution: Taplejung (Nepal) (FISCHER 1995).

General distribution: Nepal.

Orthostigma praescutellatum Fischer, 1995

Himalayan distribution: Taplejung (Nepal) (FISCHER 1995).

General distribution: Nepal.

Phaenocarpa (Phaenocarpa) angostura Bhat, 1979

Himalayan distribution: Phulchowki (Nepal) (BHAT 1979a).

General distribution: Nepal.

Phaenocarpa (Phaenocarpa) cameroni Papp, 1967

Himalayan distribution: Himachal Pradesh and West Bengal (India) (BHAT 1979a).

General distribution: China, India, Laos, Malaysia, Taiwan and Vietnam.

Phaenocarpa (Phaenocarpa) cracentis Bhat, 1979

Himalayan distribution: West Bengal (India) (Bhat 1979a).

General distribution: India.

Phaenocarpa (Phaenocarpa) flavipes (Haliday, 1838)

Himalayan distribution: Phulchowki (Nepal) (BHAT 1979a).

General distribution: Austria, Belgium, Czech Republic, Georgia, Germany, Hungary, Ireland, Italy, Lithuania, Moldova, Nepal, Netherlands, Poland, Romania, Russia, Spain, Switzerland, Ukraine and United Kingdom.

Phaenocarpa (Phaenocarpa) flavomandibula Bhat, 1979

Himalayan distribution: Kambaiti (Myanmar) (BHAT 1979a).

General distribution: Myanmar.

Phaenocarpa (Phaenocarpa) jawahari Sharma, 1979

Himalayan distribution: Himachal Pradesh and Meghalaya (India) (BHAT 1979a).

General distribution: India.

Phaenocarpa (Phaenocarpa) kashmirensis Bhat, 1979

Himalayan distribution: Jammu and Kashmir (India) (BHAT 1979a).

General distribution: India.

Phaenocarpa (Phaenocarpa) lobidentis Bhat, 1979

Himalayan distribution: Meghalaya (India) (BHAT 1979a).

General distribution: India.

Phaenocarpa (Phaenocarpa) minuta Sharma, 1979

Himalayan distribution: Sikkim (India) (BHAT 1979a).

General distribution: India.

Phaenocarpa (Phaenocarpa) shiva Bhat, 1979

Himalayan distribution: Meghalaya and Sikkim (India) (BHAT 1979a).

General distribution: India.

Phaenocarpa (Phaenocarpa) similis Bhat, 1979

Himalayan distribution: Sikkim (India) (BHAT 1979a).

General distribution: India.

Phaenocarpa (Phaenocarpa) tridentata Sharma, 1979

Himalayan distribution: Himachal Pradesh, Jammu and Kashmir and West Bengal (India) (BHAT 1979a).

General distribution: India and Malaysia.

Rhacalsia rufobalteata (Cameron, 1910)

Himalayan distribution: Meghalaya and West Bengal (India) (BHAT 1978a).

General distribution: India.

Tribe Dacnusini Foerster, 1863

Chorebus rajouriensis Fischer, 2012

Himalayan distribution: Jammu and Kashmir (India) (FISCHER 2012).

General distribution: India.

Coelinidea nigra (Nees, 1811)

Himalayan distribution: West Bengal (India) (FISCHER 2012).

General distribution: Austria, Azerbaijan, Belgium, Bulgaria, Croatia, Czech Republic, Finland, France, Germany, Hungary, India, Ireland, Italy, Lithuania, Moldova, Mongolia, Netherlands, Norway, Poland, Romania, Russia, Spain, Sweden, Sweden, Switzerland, Ukraine, United Kingdom, Uzbekistan, former Yugoslavia and Zambia.

Dacnusa (Dacnusa) flava Katiyar & Sharma, 1988

Himalayan distribution: Himachal Pradesh (India) (KATIYAR & SHARMA, 1988).

General distribution: India.

Dacnusa (Dacnusa) gangtokensis Katiyar & Sharma, 1988

Himalayan distribution: Himachal Pradesh and Sikkim (India) (KATIYAR & SHARMA 1988).

General distribution: India.

Dacnusa (Dacnusa) himalayensis Katiyar & Sharma, 1988

Himalayan distribution: Uttarakhand (India) (KATIYAR & SHARMA, 1988).

General distribution: India.

Discussion

The faunistic study of the subfamily Alysiinae of the Himalaya region (Afghanistan, Bangladesh, Bhutan, China, India, Nepal, Myanmar and Pakistan) has catalogued a total of 58 species. The distribution analysis showed great endemism, since 51 species are only recorded from this mountainous region. It should be noted that the best-known provinces are Himachal Pradesh and West Bengal, with 25 and 12 species respectively, while provinces such as Tibet (China) and Arunachal Pradesh, Manipur or Nagaland (India) are completely unexplored (Fig. 1). Despite these numbers, knowledge of the region's Alysiines remains very small, because the area under study covers 595,000 km², so one species is known for every 10,258 km². Therefore, we consider that additional studies of the Himalayan region are required to increase our knowledge about the real composition and diversity of the subfamily Alysiinae, as well as to provide the background about the applicability of these parasitoids in future biological control programs.

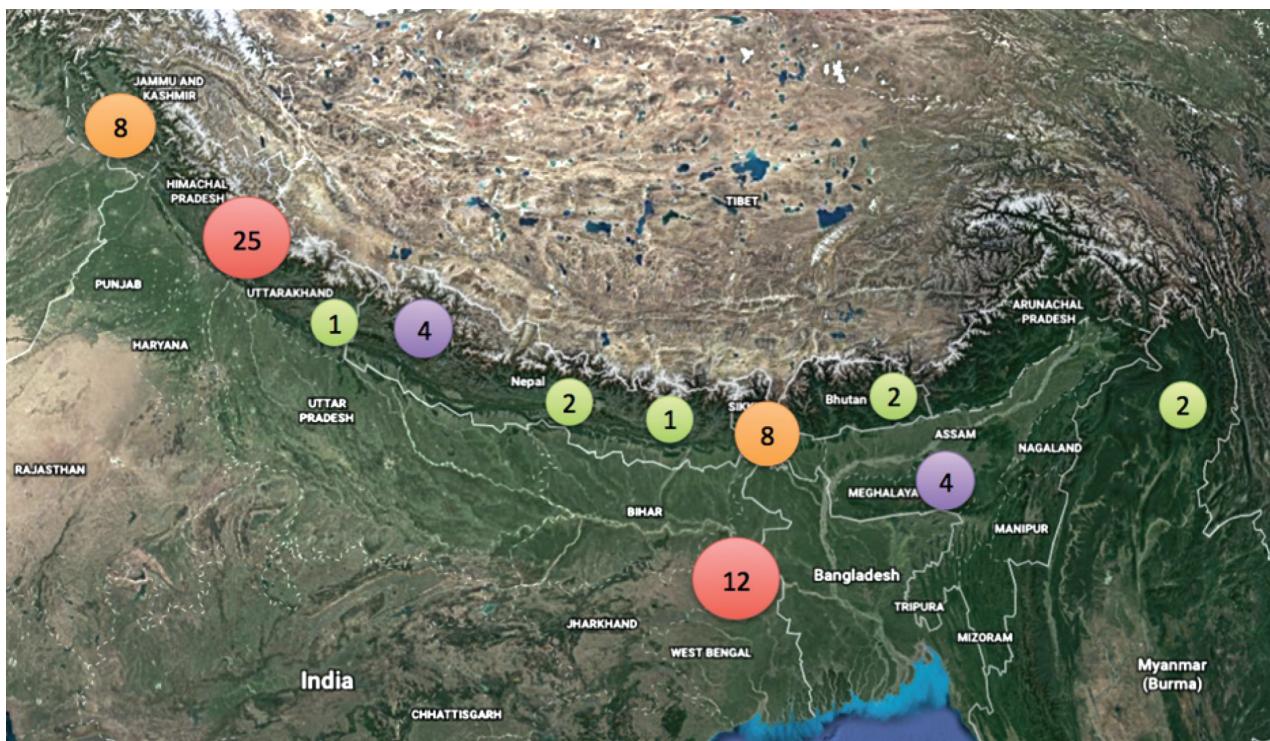


Figure 1. Distribution of known Himalayan Alysiinae species. The colours and sizes of the circles indicate the number of species recorded from the territories.

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