

Distributional records of the families Eupelmidae and Neanastatidae (Hymenoptera, Chalcidoidea) from Madhya Pradesh, India

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ABSTRACT: The parasitic hymenopteran families Eupelmidae and Neanastatidae in the superfamily Chalcidoidea have been documented in Madhya Pradesh of India. *Anastatus* (*Anastatus*) *acherontiae* Narayanan, Subba Rao & Ramachandra, 1960, *Eupelmus* (*Eupelmus*) *atus* Narendran and Anil, 1998, *E. (E.) urozonus* Dalman, 1820, *E. (E.) vermai* (Bhatnagar, 1952), *E. australis* Girault, 1915, *E. (Episolidelia) testaceiventris* (Motschulsky, 1863), *Neanastatus cinctiventris* Girault, 1913, *N. turneri* Ferriere, 1938, and *Neanastatus* sp. (species identity undetermined) are reported from Madhya Pradesh, India.

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KEY WORDS: Taxonomy, parasitoids, host, new state records

INTRODUCTION

The superfamily Chalcidoidea is one of the most biologically diverse groups of parasitic Hymenoptera. Several members have significant potential as natural enemies of various agricultural pests. Despite their importance as biocontrol agents, this group has not been thoroughly surveyed and studied in many states of India. The families Eupelmidae and Neanastatidae are small and relatively obscure within the chalcidoids. These families have been reported as primary and secondary parasitoids of various insect orders, including Hemiptera (mostly the family Pentatomidae), Lepidoptera, Coleoptera, Diptera, Hymenoptera, Orthoptera, Blattodea and even some spiders. Most of the species in these families are solitary and typically parasitize their hosts'

immature stages, such as eggs and larvae. Worldwide, numerous successful attempts have been made to utilize eupelmids against troublesome crop pests. Different species of *Anastatus* Motschusky have proved to be significant as potential control agents of pentatomid bugs. *A. bifasciatus* is among the few egg parasitoids that can develop on live brown marmorated stinkbug, *Halyomorpha halys* (Stål) eggs (Haye *et al.*, 2015), and can be mass-reared as a candidate for augmentative biological control against *H. halys*. *Anastatus bangalorensis* Mani and Kurian and *Anastatus acherontiae* Narayanan, Subba Rao and Ramachandra were recorded as egg parasitoids of the litchi stink bug, *Tessaratoma javanica* Thunberg (Choudhary *et al.*, 2015). The family Eupelmidae Walker is currently divided into three subfamilies: Eupelminae Dalman, 1820, Calosotinae

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Boucek, 1958, and Eusandalinae Fusu, 2022. Globally, it includes approximately 980 species across 39 genera (Fusu and Gibson, 2025), while in India, 87 species are distributed among 12 genera (UCD Community, 2024; Rameshkumar *et al.*, 2025; Ghosh *et al.*, 2025; Binoy *et al.*, 2025). The genus *Eupelmus* Dalman is the most speciose among the Eupelmidae globally and in India, with 30 recorded species. Most *Eupelmus* species are solitary and act as primary or secondary larval or pupal ectoparasitoids of a wide range of holometabolous insects, often in concealed environments (Gibson, 2011). The family Neanastatidae Kalina, which has been elevated from subfamily Neanastatinae of Eupelmidae to family status (Burks *et al.*, 2022), contains 47 species in two extant genera globally (UCD Community, 2024; Upadhyay *et al.*, 2025). In India, 11 species are known under genus, *Neanastatus* Girault (Narendran *et al.*, 2006; Noyes, 2024; Upadhyay *et al.*, 2025) and members of the genus are primarily parasitoids of gall midges (Cecidomyiidae, Diptera) and psyllids (Psyllidae, Hemiptera) (Narendran *et al.*, 2006). Survey on the distribution of Eupelmidae and Neanastidae was under taken in the Eastern Ghats of Madhya Pradesh.

MATERIALS AND METHODS

Collection surveys were conducted at 21 locations throughout Madhya Pradesh; Eupelmidae and Neanastatidae were identified at eight locations across Indore, Bhopal, Raisen, and Jabalpur districts. The specimens were collected using various methods, including sweep nets, yellow pan traps (YPT), and Malaise traps from different locations across the state. Notably, the sweep net collections yielded the highest number of specimens. The collected parasitoids were preserved and processed following the standard protocol (Noyes, 1982) and identified with the appropriate keys (Narendran and Anil, 1998; Narendran, 2009; Narendran *et al.*, 2006). The eupelmids were sorted, mounted, identified, and photographed using a Leica DMC4500 camera attached to a Leica M205A microscope. The photos were retouched using Adobe Photoshop CS3 Software. The specimens have been deposited in the National

Zoological Collection at the Zoological Survey of India in Kolkata, each with a registration number. A map of the study areas was prepared using QGIS software (Fig.1).

Abbreviations used: BMNH = Natural History Museum, London, UK; DZUC=Department of Zoology, University of Calicut, Kerala, India; IARI = Division of Entomology, Indian Agricultural Research Institute, New Delhi, India; NRS = Naturhistoriska Riksmuseet Stockholm, Sweden; NZCZSI = National Zoological Collection, Zoological Survey of India; QMB = Queensland Museum, Brisbane, Australia; SEA = School of Entomology, St. John's College, Agra, India; ZMMU = Zoological Museum of Moscow State University, Moscow, Russia.

RESULTS AND DISCUSSION

The study documents Eupelmidae and Neanastatidae species for Madhya Pradesh, with two genera and eight species identified as new records for the state.

Order **Hymenoptera**; Superfamily **Chalcidoidea**;
Family **Eupelmidae**;

Subfamily **Eupelminae**

Genus *Anastatus* Motschulsky, 1859; Subgenus *Anastatus* Motschulsky, 1859

1. *Anastatus (Anastatus) acherontiae* Narayanan, Subba Rao & Ramachandra, 1960 (**Fig. 2a**)

Anastatus acherontiae Narayanan, Subba Rao & Ramachandra, 1960: 171, Proceedings of the National Institute of Sciences of India (B), Holotype Female, India, Delhi (IARI).

Materials examined: 1♀, India: Madhya Pradesh, Bhopal, Indian Institute of Science Education and Research, 22.2246°N; 77.2729°E, 27.ix.2024, Sweep Net, Coll. A. Rameshkumar; 1♀, Raisen, Banskwar, 22.9659°N; 77.6072°E, 29.ix.2024, Sweep Net, Coll. A. Rameshkumar; (Reg. No. 33897/H3, NZCZSI).

Distribution: India: Delhi, Himachal Pradesh, Punjab, Kerala, Tamil Nadu, Madhya Pradesh (**New record**).

Hosts: *Acherontia styx* (Westwood) (Lepidoptera, Sphingidae) (Narayanan *et al.*, 1960); Pentatomidae (Hemiptera) eggs (Narendran, 2009).

Genus *Eupelmus* Dalman, 1820; Subgenus *Eupelmus* Dalman, 1820.

2. *Eupelmus (Eupelmus) atus* Narendran and Anil, 1998 (Fig. 2b)

Eupelmus atus Narendran and Anil, 1998: 9, Journal of the Zoological Society of Kerala, Holotype Female, India, Kerala, Parambikulam (DZUC).

Materials examined: 1 ♀, India: Madhya Pradesh, Indore, Indian Institute of Soybean Research, 22.6826°N; 75.8695°E, 21.ix.2024, YPT, Coll. A. Rameshkumar; (Reg. No. 33898/H3, NZCZSI).

Distribution: India: Kerala, Madhya Pradesh (**New record**).

Host: Unknown.

Remarks: After the discovery of this species in 1998 from Kerala (Narendran and Anil, 1998), it is for the first time this species is found again with its extended distribution in Madhya Pradesh.

3. *Eupelmus (Eupelmus) urozonus* Dalman, 1820 (Fig. 2f)

Eupelmus urozonus Dalman, 1820: 378, Kungliga Svenska Vetenskapsakademiens Handlingar, Holotype Female, Sweden (? NRS).

Materials examined: 1 ♀, India: Madhya Pradesh, Indore, Umrikheda, 22.6118°N; 75.8876°E, 24.ix.2024, Sweep Net, Coll. A. Rameshkumar; 1 ♀, Indore, Malendi Village, 22.4985°N; 75.7741°E, 22.ix.2024, YPT, Coll. A. Rameshkumar; (Reg. No. 33899/H3, NZCZSI).

Distribution: India: Delhi, Gujarat, Tamil Nadu, West Bengal, Madhya Pradesh (**New record**)

Host: Coleoptera: Apionidae (Islam and Hayat, 1986), Attelabidae, Chrysomelidae, Coccinellidae, Curculionidae (Herting, 1973); Diptera: Agromyzidae (Abdul-Nasr and Assem, 1969),

Cecidomyiidae (Narendran and Anil, 1998), Tephritidae (Noyes, 2024); Hemiptera: Aphididae, Coccidae (Herting, 1972); Hymenoptera: Cynipidae, Diprionidae, Eurytomidae, Pteromalidae, Siricidae, Tenthredinidae, Torymidae (Noyes, 2024); Lepidoptera: Cecidosidae, Coleophoridae, Gelechiidae, Gracillariidae, Lasiocampidae, Lymantriidae, Momphidae, Notodontidae, Pieridae, Pyralidae, Tortricidae, Yponomeutidae (Noyes, 2024).

4. *Eupelmus (Eupelmus) vermai* (Bhatnagar, 1952) (Fig. 2e)

Solindenia vermai Bhatnagar, 1952: 162, Indian Journal of Agricultural Science, Holotype Female, India, Kanpur (? SEA).

Materials examined: 2 ♀, India: Madhya Pradesh, Indore, Umrikheda, 22.6118°N; 75.8876°E, 24.ix.2024, Sweep Net, Coll. A. Rameshkumar; (Reg. No. 33900/H3, NZCZSI).

Distribution: India: Uttar Pradesh, Goa, Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh (**New record**)

Host: Coleoptera: Coccinellidae (Herting, 1973).

Subgenus *Episolinodelia* Girault, 1914

5. *Eupelmus (Episolinodelia) australis* Girault, 1915 (Fig. 2c)

Eupelmus australis Girault, 1915: 6, Memoirs of the Queensland Museum, Holotype Female, Australia, Brisbane (QMB).

Materials examined: 3 ♀, India: Madhya Pradesh, Indore, Umrikheda, 22.6118°N; 75.8876°E, 24.ix.2024, Sweep Net, Coll. A. Rameshkumar; (Reg. No. 33779/H3, NZCZSI).

Distribution: India: Kerala, Madhya Pradesh (**New record**).

Host: Unknown.

Remarks: The species was so far known only from Kerala (Narendran and Anil, 1998)

6. *Eupelmus (Episolindelia) testaceiventris* (Motschulsky, 1863) (Fig. 2d)

Roptrocerus testaceiventris (Motschulsky, 1863: 49), Byulleten' Moskovskogo Obshchestva Ispytateley Prirody (Otdel Biologicheskii), Holotype Female, Sri Lanka, Mt. Nuara Eliya (ZMMU).

Materials examined: 2♀, India: Madhya Pradesh, Indore, Umrikheda, 22.6118°N; 75.8876°E, 24.ix.2024, Sweep Net, Coll. A. Rameshkumar; 6♀, Jabalpur, Tropical Forest Research Institute, 23.1106°N; 79.9402°E, 3.x.2024, Sweep Net, Coll. A. Rameshkumar; 3♀, Jabalpur, Bhamki Village, 23.1435°N; 79.6734°E, 5.x.2024, Sweep Net, Coll. A. Rameshkumar; 2♀, Jabalpur, Tripur Sundari Temple Road, 23.1468°N; 79.8186°E, 5.x.2024, Sweep Net, Coll. A. Rameshkumar; 1♀, Bhopal, Indian Institute of Science Education and Research, 22.2246°N; 77.2729°E, 27.ix.2024, Sweep Net, Coll. A. Rameshkumar; 1♀, Raisen, Bhimbetka, 22.9395°N; 77.6124°E, 29.ix.2024, Sweep Net, Coll. A. Rameshkumar; (Reg. No. 33781/H3, NZCZSI).

Distribution: India: Maharashtra, West Bengal, one report of this species from India without mention of state in CBIC Annual Report 1984-1985: 30. Commonwealth Agricultural Bureaux, Slough, U.K., Madhya Pradesh (**New record**).

Host: Diptera: Cecidomyiidae (Askew and Nieves-Aldrey, 2000); *Contarinia sorghicola* (Coq.) (Herting, 1978); *Procontarinia matteiana* Kieffer and Cecconi (CIBC, 1985).

Remarks: Since many specimens were collected from different localities of the study area, this species seems to be a common species. The distribution of this species was reported to be limited to Maharashtra and West Bengal so far.

Family Neanastatidae; Genus *Neanastatus* Girault, 1913

7. *Neanastatus cinctiventris* Girault, 1913 (Fig. 3a).

Neanastatus cinctiventris Girault, 1913: 35, Bulletin of the Wisconsin Natural History Society (new series). Syntypes Female, Australia, Queensland (QMB).

Materials examined: 1♀, India: Madhya Pradesh, Jabalpur division, Mandla, Paprikalam, 22.9581°N; 79.9676°E, 4.x.2024, Sweep Net, Coll. A. Rameshkumar; 1♀, Jabalpur, Tropical Forest Research Institute, 23.1106°N; 79.9402°E, 3.x.2024, Sweep Net, Coll. A. Rameshkumar; (Reg. No. 33901/H3, NZCZSI).

Distribution: India: Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Odisha, Tamil Nadu, Uttar Pradesh.

Host: *Orseolia oryzae* (Wood-Mason) (Diptera, Cecidomyiidae) (Narendran *et al.*, 2006).

8. *Neanastatus turneri* Ferriere, 1938 (Fig. 3b)

Neanastatus turneri Ferriere, 1938: 65, Annales de la Société Entomologique de France. Holotype Female, South Africa, (BMNH).

Materials examined: 1♀, India: Madhya Pradesh, Jabalpur, Tropical Forest Research Institute, 23.1106°N; 79.9402°E, 3.x.2024, Sweep Net, Coll. A. Rameshkumar; (Reg. No. 33903/H3, NZCZSI).

Distribution: India: Andhra Pradesh, Kerala, Uttar Pradesh, Uttarakhand, Madhya Pradesh (**New record**).

Host: *Asphondylia punica* Marchal (Diptera, Cecidomyiidae) (Askew & Nieves-Aldrey, 2006).

9. *Neanastatus* sp. (Fig. 3c)

Materials examined: 1♂, India: Madhya Pradesh, Jabalpur, Hirapur Village, 23.0724°N; 79.5231°E; 5.x.2024, Sweep Net, Coll. A. Rameshkumar; 1♂, Jabalpur, Bhamki Village, 23.1435°N; 79.6734°E, 5.x.2024, Sweep Net, Coll. A. Rameshkumar; 1♂, Bhopal, Udaygiri, 23.5360°N; 77.7718°E, 28.ix.2024, Sweep Net, Coll. A. Rameshkumar.

Remarks: This species looks very close to *Neanastatus turneri* but differs from it in having bright yellow colour in the anterior part of acropleuron and an orange-yellow metasoma with black stripes. Since only male specimens were found in the collections, the identity of the species could not be ascertained.

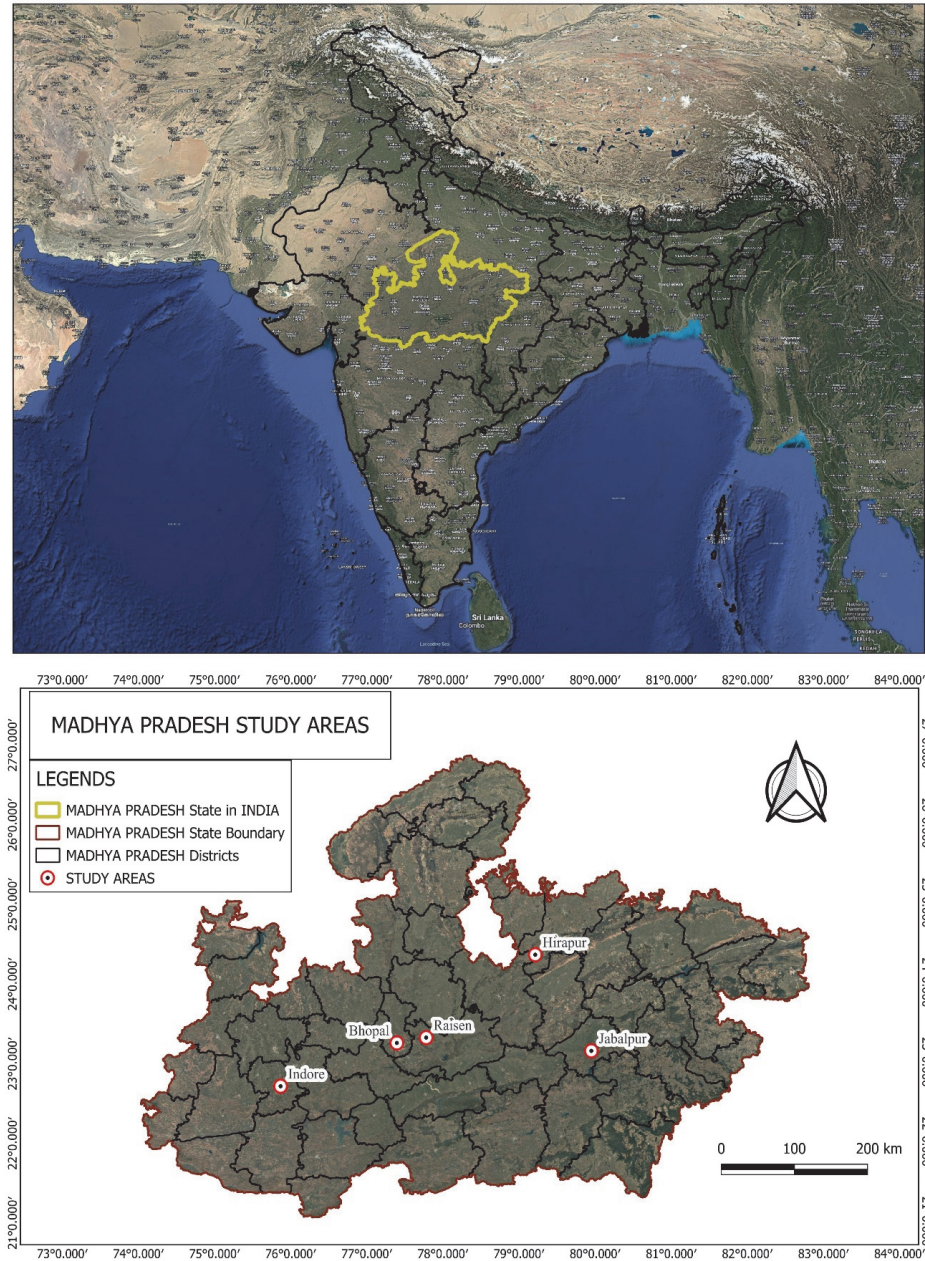


Fig. 1 The study areas in Madhya Pradesh

In India, studies on Eupelmidae and Neanastatidae are limited to the reports of a few species mainly from Kerala, Tamil Nadu and Uttar Pradesh. Extensive surveys were conducted under experts such as T.C. Narendran and M. Hayat who provided valuable insights on Indian fauna of these parasitoids. However, there is limited knowledge about eupelmids in most states of India, including

Madhya Pradesh, where only one species, *Neanastatus cinctiventris* Girault, 1913 has been reported (Islam and Hayat, 1986). The group is considered underdocumented in India despite their economic importance. Therefore, the relatively unexplored central region of the country was chosen as the study area. The dominant vegetation here consists of moist deciduous forests along with

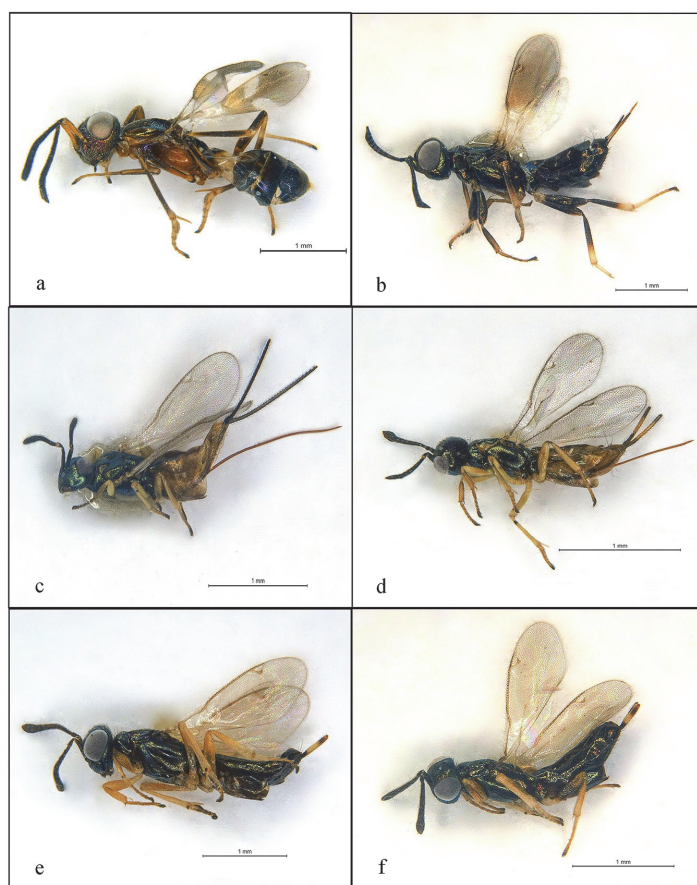


Fig. 2 Family Eupelmidae: a - *Anastatus acherontiae*; b - *Eupelmus atus*; c - *E. australis*; d - *E. testaceiventris*; e - *E. vermai*; f - *E. urozonus*

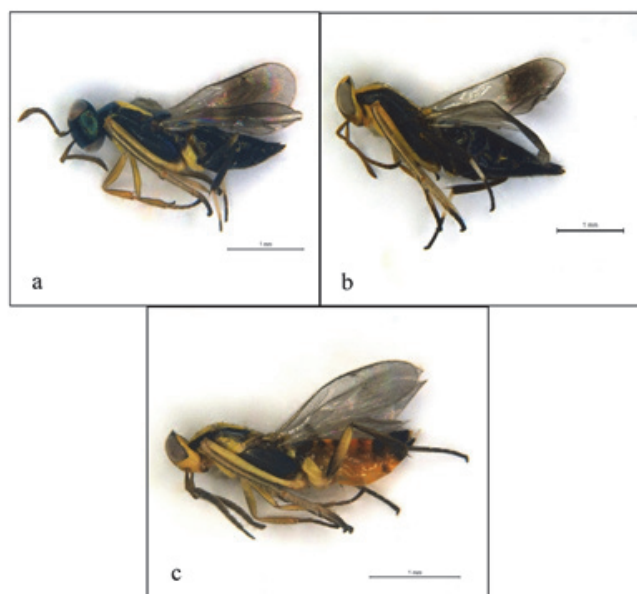


Fig. 3 Family Neanastatidae: a. *Neanastatus cinctiventris*; b. *N. turneri*; c. *Neanastatus* sp. (Male)

bamboo thickets and mixed forests. Though substantial numbers of parasitoids were collected in the survey material, eupelmids were comparatively rare among them in most collection methods. Furthermore, due to significant sexual dimorphism, accurate species identification typically relies on female specimens for most eupelmids. This study presents a list of Eupelmidae and Neanastatidae species for Madhya Pradesh, with two genera and eight species identified as new records for the state. Within the limited collection of the group, one species is reported for the first time here after its discovery and four species known only from a few states show extended distribution. Moreover, common occurrence of one species throughout the collection, which so far showed limited distribution, underlines the lack of proper documentation of the group. Considering their immense potential in biological control, further exploration of these natural enemies is essential to provide comprehensive knowledge on their diversity and distribution in India. Bridging knowledge gaps in host information and association of males with their female counterparts is also imperative.

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