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A study on the distribution pattern of genus *Elasmus westwood* (Hymenoptera: Eulophidae) from Chhattisgarh

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Abstract

The genus *Elasmus* Westwood was studied in different natural and agricultural ecosystem of Chhattisgarh. At present 118 specimens are studied from Chhattisgarh. The distribution pattern of *Elasmus* Westwood was analyzed and digitized. It was distributed in four biogeographic realms, namely: Nearctic, Neotropical, Palearctic, Afrotropical, Oriental and Australasia. In India it had been distributed in Andaman and Nicobar Islands, Andhra Pradesh, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Puducherry, Rajasthan, Punjab, Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal and Karnataka. In present study, it had been reported from Jashpur Balrampur, Raigarh, Mungeli Mahasamund, Kawardha, Dhamtari, Gariyaband, Surguja, Rajanandgaon, Durg, Korba, Raipur and Jagdalpur districts of Chhattisgarh.

Keywords: Distribution pattern, *Elasmus westwood*, Chhattisgarh

Introduction

The Chhattisgarh is the part of central India. The State falls under East Deccan physiographic zone and can be divided into three agro-climatic zones, viz. the Chhattisgarh Plains, the Northern Hills of Chhattisgarh and the Bastar Plateau. It covers an area of 1,35,192 sq km, which is 4.11% of the geographical area of the country. The state has forest area of 59,772 sq km, which is 44.21% of states geographical area and ranks third in the country in terms of forest covers. The state has three National Parks and eleven Wildlife Sanctuaries which constitute 4.93% of state geographical area. It has a tropical hot and humid climate. The average annual rainfall varies from about 1,100 mm to about 1,700 mm and the average annual temperature ranges between 11 °C to 47 °C.

Eulophidae is the largest family under superfamily Chalcidoidea representing more than 5,000 species in 330 genera worldwide. In India, it is represented by 636 species in 112 genera (Noyes, 2019) [3]. Kazmi & Girish (2015) [1] had made an attempt to describe the eulophidae genera from Chhattisgarh. They described three species of genus *Elasmus* viz., *Elasmus brevicornis* Gahan, *Elasmus johnstoni* Ferriere and *Elasmus queenslandicus* Girault with their distribution pattern.

The biodiversity of Chhattisgarh fauna of parasitic Hymenoptera has remained unexplored. Lack of information on basic knowledge of natural enemies, and their improper identification will hinder in the development of proper management practices. An advancement of taxonomic knowledge is greatly needed in the arena of basic studies in relation to biodiversity of faunal studies, host parasitoids relationship, etc. before going in for an adventure in the field of biological control (Singh, 2005) [4].

Method and Materials

The Chhattisgarh state lies between 17°47' N to 24°06' N latitude and 80°15' E to 84°24' E longitude. The different places surveyed during the study are as follows (Fig. 1): Achanakmar Wildlife Sanctuary; Badalkhol Wildlife Sanctuary; Barnawapara Wildlife Sanctuary; Boramdev Wildlife Sanctuary; Gomardha Wildlife Sanctuary; Semarsot Wildlife Sanctuary; Sitanadi Wildlife Sanctuary; Tamor Pingla Wildlife Sanctuary; Udanti Wildlife Sanctuary; Kanger Valley National Park; College of Agriculture, Raipur; RMD CARS, Ambikapur; KVK, Mainpat; SG CARS, Jagdalpur; Bachha Batha, Dongargarh; KVK, Durg, Anjora; Badechakwa, Jagdalpur; Devpahari, korba; KVK, Balrampur. The permission was obtained from the Office of the Principal Chief Conservator of Forests (Wildlife Management & Biodiversity Conservation cum-Chief Wildlife Warden) Chhattisgarh for the sample collection *via*

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letter no. 5581, dated 06/10/2018. The Eulophid specimens were collected using yellow pan traps, malaise traps and sweep net. The traps were filled with solution (salt, liquid dish wash, water) and were placed at a distance of approximately one meter away from each other. One Malaise trap was installed for 5-7 days at each location. The collected insects were preserved in 70% ethyl alcohol. Sweep net (SN) was used for catching Eulophid from the various ecosystems (natural and agro ecosystems). The collected specimens were killed using ethyl acetate and were later preserved in 70% ethyl alcohol. All the specimens were deposited in the National Insect Museum of ICAR-National Bureau of Agricultural Insect Resources, Bengaluru, India.

Result and Discussion

Genus *Elasmus* Westwood, 1833

Synonymy

Elasmus Westwood, 1833: 343. Type species *Eulophus flabellatus* Fonscolombe, by monotypy.

Aneure Nees, 1834: 194. Type species *Aneure nuda* Nees, designated by Gahan & Fagan, 1923: 12. Synonymised by Westwood, 1833, 1839.

Heptocondyla Rondani, 1877: 182. Type species *Epicondyle unicolor* Rondani, by monotypy. Synonymised by Bouček, 1974.

Cyclopleura Cameron, 1913: 96. Type species *Cyclopleura fumipennis* Cameron (*Elasmus cameroni* Verma & Hayat as replacement name, Verma *et al.*, 2002., designated by Gahan & Fagan, 1923: 41. Synonymised by Waterson, in Mahdihassan, 1925.

Austelasmus Riek, 1967: 148. Type species *Elasmus trifasciiventris* Girault, by original designation. Synonymised by Burks, in Krombein *et al.*, 1979.

Diagnosis

Female: Antennal formula 11233; pronotum triangular; mesoscutum with notauli indicated in about anterior half; axillae relatively small, slightly produced anteriorly and both axillae connected by a bridge; scutellum with two pairs of stout bristles; metanotum with a triangular lamella medially jutting over propodeum; propodeum postero-laterally emarginated for reception of enlarged hind coxae; legs with four segmented tarsi; fore wing with MV relatively long and STV short; fore tibial spur straight; hind coxa enlarged and flattened, disc shaped; hind tibia with setae arranged in diamond shaped pattern; gaster elongate with 7 tergites, T1 longest.

Male: Similar to female except: antennal formula 11243 with F1 to F3 with a dorsal ramus on each.

Specimen Examined

INDIA: Chhattisgarh: 7F and 4M, Badalkhol Wildlife Sanctuary, Jashpur 22°89'60"N 83°91'58"E, 596m, 04.ix.2018, Coll. Rajesh Kumar Ekka; 8F and 2M, Semarsot Wildlife Sanctuary, Balrampur, 23°32'54"N 83°32'46"E, 668m, 10.xi.2018, Coll. Rajesh Kumar Ekka; 4F, Tamor Pingla Wildlife Sanctuary, Surajpur, 23°45'86"N 82°54'57"E, 618m, 03.vii.2019 Coll. Rajesh Kumar Ekka; 2F, Gomardha Wildlife Sanctuary, Raigarh, 21°40'84"N 83°18'66"E, 468m, 23.v.2019 Coll. Rajesh Kumar Ekka; 2F, Achanakmar Wildlife Sanctuary, Mungeli 22°26'44"N 81°42'33"E, 528m,

18.vii.2019, Coll. Rajesh Kumar Ekka; 5F and 2M, Barnawapara Wildlife Sanctuary, Mahasamund, 21°29'83"N 82°31'67"E, 337m, 18.viii.2019, Coll. Rajesh Kumar Ekka; 4F, Boramdev Wildlife Sanctuary, Kawardha, 22°10'19"N 81°03'92"E, 698m, 28.x.2019, Coll. Rajesh Kumar Ekka; 9F, Sitanadi Wildlife Sanctuary, Dhamtari, 20°20'56"N 81°57'39"E, 415m, 19.ii.2019, Coll. Rajesh Kumar Ekka; 9F, Udanti Wildlife Sanctuary Gariyaband, 20°07'09"N 82°22'57"E, 354m, 06.i.2019, Coll. Rajesh Kumar Ekka; 15F, Kanger Valley National Park, Jagdalpur, 18°57'09"N 82°14'68"E, 554m, 14.ix.2018, Coll. Rajesh Kumar Ekka; 7F, RMD CARS, Ambikapur, Surguja, 23°08'38"N 83°08'60"E, 623m, 28.ix.2019, Coll. Rajesh Kumar Ekka; 4F, KVK, Mainpat, Surguja 22°49'38"N 83°16'28"E, 1095m, 05.ix.2018, Coll. Rajesh Kumar Ekka; 9F, KVK, Balrampur, 23°36'23"N 83°36'23"E, 530m, 27.ix.2019, Coll. Rajesh Kumar Ekka; 2F, Bachha Batha, Dongargarh, Rajanandgaon, 21°13'20"N 80°43'07"E, 490m, 16.i.2019, Coll. Rajesh Kumar Ekka; 1F, KVK, Anjora, Durg, 21°10'06"N 81°14'10"E, 289m, 27.i.2019, Coll. Rajesh Kumar Ekka; 2F, Devpahari, Korba, 22°38'12"N 82°48'41"E, 293m, 13.ii.2019 Coll. Rajesh Kumar Ekka; 5F, College of Agriculture, Raipur, 21°14'02.2"N 81°42'42.5"E, 298m, 23.viii.2018, Coll. Rajesh Kumar Ekka; 5F, Bana nursery, Raipur, 21°14'02.2"N 81°42'42.5"E, 298m, 03.ix.2018, Coll. Rajesh Kumar Ekka; 2F, Badechakma, Jagdalpur 19°09'26"N 81°49'34"E, 560m, 31.i.2019, Coll. Rajesh Kumar Ekka, 7F, SG CARS, Jagdalpur, 19°05'33.9"N 81°57'38.7"E, 557m, 14.ix.2018, Coll. Rajesh Kumar Ekka.

Distribution Pattern of Genus *Elasmus* Westwood

World: Nearctic, Neotropical, Palaearctic, Afrotropical, Oriental and Australasia.

India: Andaman and Nicobar Islands, Andhra Pradesh, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Puducherry, Rajasthan, Punjab, Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal and Karnataka.

Chhattisgarh: Jashpur Balrampur, Raigarh, Mungeli Mahasamund, Kawardha, Dhamtari, Gariyaband, Surguja, Rajanandgaon, Durg, Korba, Raipur and Jagdalpur

The genus *Elasmus* Westwood is distributed all over the six biogeographic realms, viz. Nearctic, Neotropical, Palaearctic, Afrotropical, Oriental and Australasia (Noyes, 2019)^[3] and in India, genus *Elasmus* Westwood was reported in Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Odisha, Puducherry, Rajasthan, Punjab, Maharashtra, Delhi and Goa by Kazmim and Girish in 2015, whereas from Haryana, Himachal Pradesh, Jammu and Kashmir, Kerala, Madhya Pradesh, Meghalaya, Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal and Karnataka it was reported by Narendran in 2011.

Table 1. shows the distribution of Genus *Elasmus* Westwood in the three agroclimatic zone of Chhattisgarh were as Fig 1, shows the distribution pattern more precisely on the map of Chhattisgarh. In Chhattisgarh, it had been observed from Achanakmar Wildlife Sanctuary, Mungeli (22°26'44"N, 81°42'33"E, 528m), Badalkhol Wildlife Sanctuary, Jashpur (22°89'60"N, 83°91'58"E, 596m), Barnawapara Wildlife Sanctuary, Mahasamund (21°29'83"N, 82°31'67"E, 337m), Boramdev Wildlife Sanctuary, Kawardha (22°10'19"N, 81°03'92"E, 698m), Gomardha Wildlife Sanctuary, Raigarh (21°40'84"N, 83°18'66"E, 468m), Semarsot Wildlife

Sanctuary, Balrampur (23°32'54"N, 83°32'46"E, 668m), Sitanadi Wildlife Sanctuary, Dhamtari (20°20'56"N, 81°57'39"E, 415m), Tamor Pingla Wildlife Sanctuary, Surajpur (23°45'86"N, 82°54'57"E, 618m), Udanti Wildlife Sanctuary, Gariyaband (20°07'09"N, 82°22'57"E, 354m) and Kanger Valley National Park, Jagdalpur (18°57'09"N, 82°14'68"E, 554m) under natural ecosystem were as from agricultural ecosystem it had been observed from College of Agriculture, Raipur (21°14'02.2"N, 81°42'42.5"E, 298m), RMD CARS, Ambikapur, Surguja (23°08'38"N, 83°08'60"E, 623m), KVK, Mainpat, Surguja (22°49'38"N, 83°16'28"E, 1095m), SG CARS, Jagdalpur (19°05'33.9"N, 81°57'38.7"E, 557m), Bachha Batha, Dongargarh, Rajanandgaon (21°13'20"N, 80°43'07"E, 490m), KVK, Anjor, Durg (21°10'06"N, 81°14'10"E, 289m), Badechakma, Jagdalpur (19°09'26"N, 81°49'34"E, 560m), Devpahari, Korba (22°38'12"N, 82°48'41"E, 293m), KVK, Balrampur (23°36'23"N, 83°36'23"E, 530m) and Bana Nursery, Raipur (21°14'02.2"N, 81°42'42.5"E, 298m).

author, Rajesh Kumar Ekka. This study began in 2018 and was completed in 2020. I thank the Indira Gandhi Agricultural University, Raipur (C.G.) for accomplishing the tenure to work at NBAIR, Bangalore (Karnataka). I would like to thank forest department of Chhattisgarh for granting the permission to conduct the survey in the different Wildlife sanctuaries and National Park of Chhattisgarh. I would like to thank Ministry of Tribal affairs, Govt. of India for granting fellowship for the conduction of research.

Table 1: Distribution of genera *Elasmus* Westwood from different natural and agricultural Ecosystem of Chhattisgarh

| Genus | Natural Ecosystem | | | | | | | | | |
|----------------------------|------------------------|--------|--------|--------|-------|--------|--------|--------|--------|-------|
| | AM WLS | BK WLS | BN WLS | BD WLS | GW LS | SSW LS | SN WLS | TP WLS | UW LS | KV NP |
| <i>Elasmus</i> Westwood | + | + | + | + | + | + | + | + | + | + |
| | Agricultural Ecosystem | | | | | | | | | |
| | COA-R | RMD-A | KVK-M | SG-J | BB-R | KV-K-D | BCK-J | DP-K | KV-K-B | BN-R |
| | + | + | + | + | + | + | + | + | + | + |

"+" = Present; "-" = Absent

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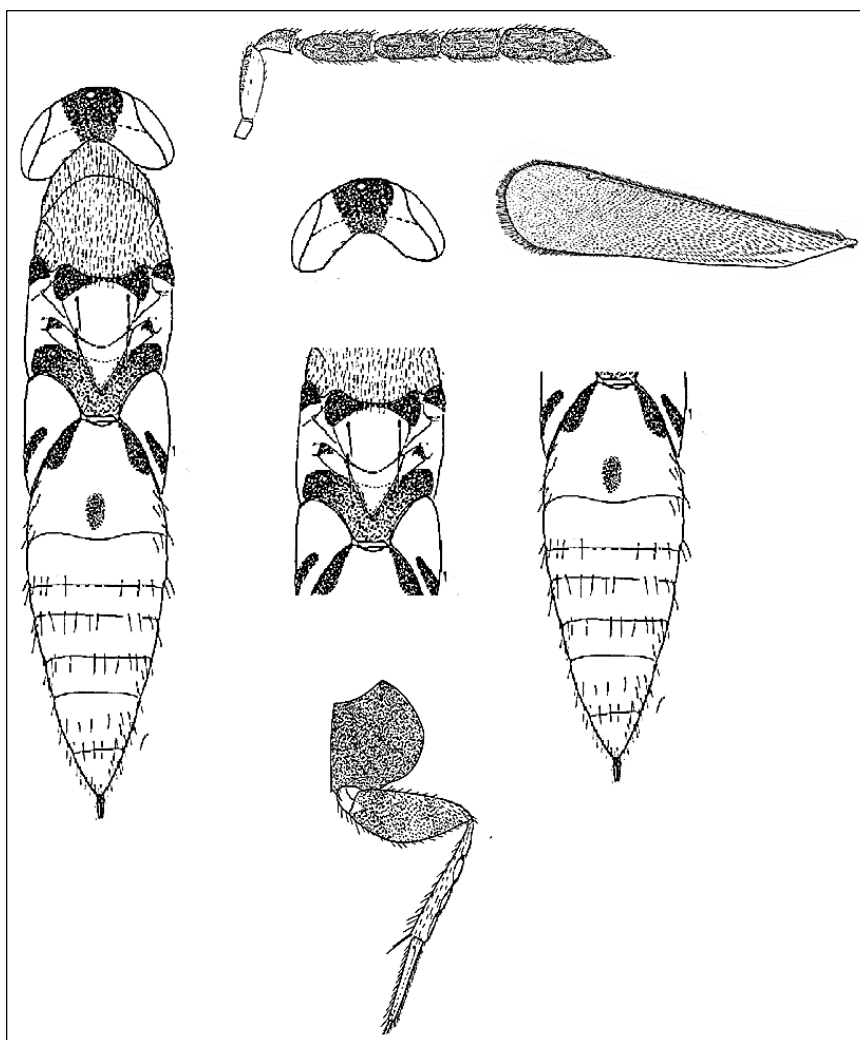


Fig 1: *Elasmus* Westwood, 1833; Female: A. Body - dorsal view; B. Antenna; C. Head dorsal view; D. Wing E. Mesoscutum; E. Metasoma; F. Hind coxa

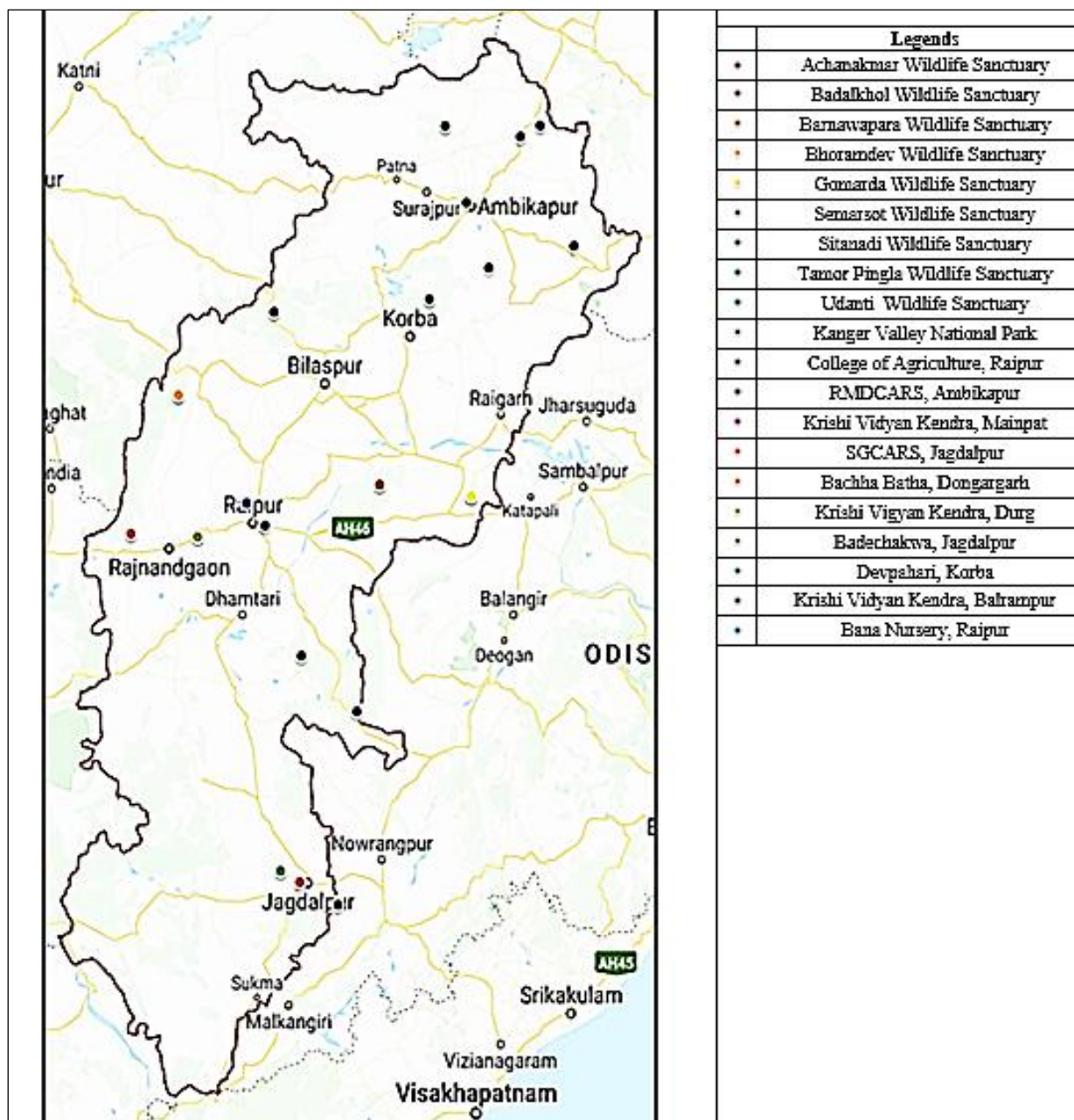


Fig 2: Distribution pattern of *Elasmus* Westwood in the three Agro-climatic zone of Chhattisgarh

Table 3: Abbreviation used in the text for survey area

| Abbreviation | Sites surveyed during study |
|--------------|---------------------------------|
| AMWLS | Achanakmar Wildlife Sanctuary |
| BKWLS | Badalkhol Wildlife Sanctuary |
| BNWLS | Barnawapara Wildlife Sanctuary |
| BDWLS | Bhoramdev Wildlife Sanctuary |
| GWLS | Gomardha Wildlife Sanctuary |
| SSWLS | Semarsot Wildlife Sanctuary |
| SNWLS | Sitanadi Wildlife Sanctuary |
| TPWLS | Tamor Pingla Wildlife Sanctuary |
| UWLS | Udanti Wildlife Sanctuary |
| KVWLS | Kanger Valley National Park |
| COA-R | College of Agriculture, Raipur |
| RMD-A | RMD CARS, Ambikapur |
| KVK-M | KVK, Mainpat |
| SG-J | SG CARS, Jagdalpur |
| BB-R | Bachha Batha, Dongargarh |
| KVK-D | KVK, Durg, Anjora |
| BCK-J | Badechakwa, jagdalpur |
| DP-K | Devpahari, Korba |
| KVK-B | KVK, Balrampur |
| BN-R | Bana Nursery, Raipur |

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