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An Egg parasitoid, *Mirufens* Girault (Hymenoptera: Trichogrammatidae) Reared from *Oxyrachis tarandus* Fab. Attacking on *Cassia fistula* L. (India)

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ABSTRACT

Cassia fistula L. is known as Golden shower or Amaltas has therapeutics importance in health care since ancient times. It shows a pivotal role in diseases prevention due to their valuable ingredients in different parts of plants. One of known hemipterous insect pest, attacking on this valuable tree is *Oxyrachis tarandus* Fab. (Hemiptera: Membracidae), its nymphs and adults feed gregariously on the sap of the shoot of host plant results in the stunting or death of the infested shoot. *Oxyrachis tarandus* population may be checked by some natural parasitoids. *Mirufens* Girault is one of important egg parasitoid recorded on this hemipterous insect pest, attacking on different host plants. In the present study, we are recorded egg parasitoid *M. afrangiata* from the eggs of *Oxyrachis tarandus*, infesting *Cassia fistula* plant for the first time. Re-described and illustrated two species of the genus *Mirufens*; *M. afrangiata* and *M. brevifuniculata* along with first male record of *M. brevifuniculata*. An updated key to the Indian species of *Mirufens* are also provided.

Keywords: Trichogrammatids, Biological control agent, Hemiptera, Amaltas.

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INTRODUCTION

Cassia fistula L. (Fig. 1a) is commonly known as Amaltas/Indian laburnum/Golden shower has been widely used in different types of traditional medicines including Ayurveda, Unani and Chinese in the treatment and prevention of diseases. It shows a pivotal role in diseases prevention due to their valuable ingredients in different parts of plants such as stem, leaf, and flower. Some of the constituents (rhein, triterpenes, sugar, and potassium) show role as antimicrobial, anti-diabetic and antioxidant, and other types has therapeutic implications in cancer prevention (Rahmani, 2015). Important known hemipterous insect pest, attacking on this valuable tree is *Oxyrachis tarandus* (Hemiptera: Membracidae), widely distributed in India and adjacent countries. The nymphs and adults feed gregariously on the sap of the shoot of different host plants such as *Acacia catechu*, *A. nilotica*, *Albizia chinensis*, *A. lebbek*, *Cassia fistula*, *Dalbergia latifolia*, *Prosopis juliflora*, *P. cineraria*, *Santalum album*, *Tamarindus indica*. Females are laid her eggs on shoots in a V-shaped slit (Fig. 1b) and injury often results in the stunting or death of the infested shoot. Some natural parasitoids are also recorded, which may check the population and reduce the infestation of this insect pest. *Mirufens* Girault is important egg parasitoid belongs to the family Trichogrammatidae recorded on various hemipterous insects such as *Lapidosaphes ulmi* on *Betula* sp. (Erdos, 1956); *Oxyrachis tarandus* on *Acacia* sp. and *Prosopis juliflora* Viggiani & Hayat (1974).

Here, we have recorded egg parasitoid *M. afrangiata* from the eggs of *Oxyrachis tarandus*, infesting *Cassia fistula* plant for the first time. Re-described and illustrated two species of the genus *Mirufens*; *M. afrangiata* and *M. brevifuniculata* along with first male record of *M. brevifuniculata*. An updated key to the Indian species of *Mirufens* has been provided.

Figure 1. a) *Cassia fistula* plant (Amaltas), b) parasitized egg bunch of *Oxyrachis tarandus* on twig of *Cassia fistula*.

MATERIAL AND METHODS

Survey was conducted in forestry and agro-forestry areas of Haryana, and Uttar Pradesh (India) during June-July, 2018 and reared 14 specimens of egg parasitoid from egg bunches of *Oxyrachis tarandus* on twigs of *Prosopis juliflora* and *Cassia fistula*. Further, specimens were preserved in 70% alcohol. Following the normal process of dehydration, specimens were dissected in clove oil under stereoscopic microscope for studying the important morphological taxonomic characters; dissected body parts were kept in a drop of Euparol on slides and covered with cover slips. Only body lengths of specimens were measured in millimeters, all other measurements were taken from the divisions of a linear scale micrometer placed in the eye piece of a Nikon Digital Sight attached with Optiphot Microscope, at 10×, 20× and 40× (objective lens) for slide-mounted parts. Scales are placed on photographs of slide mounted parts and measurement was taken with the help of NIS-ELEMENT software in micrometer (µm).

Photographs of slide–mounted specimens were taken with digital camera "Nikon Digital Sight attached with Optiphot Microscope (Japan)" fitted over a compound microscope (Leica's Leitz Labor Lux S). All specimens were submitted to NFIC (National Forest Insect Collection), Forest Protection Division, Forest Research Institute, Dehradun, Uttarakhand (India).

The following abbreviations are used: OOL = Ocello-ocellar length; POL= Post-ocellar; C1 & C2= Club segments 1 & 2; FWW= Fore wing width; STV= Stigmal vein; MV= Marginal vein; PM= Pre marginal vein.

RESULTS

Key to Indian species of the genus *Mirufens* Girault based on females

Mirufens Girault includes 14 described (including four Indian species) valid species in the world (Noyes, 2022)

1. Fore wings with marginal fringe present; ovipositor arising from base of men…...2
- Fore wings with marginal fringe absent; ovipositor not arising from base of abdomen.....3
2. F1 and F2 wider than long, club less than 4× as long as wide; MV shorter than STV…….....….....……..….....*M. mangiferae*
- F1 distinctly longer than wide, about 1.5× as long as wide; club more than 4× as long as wide; MV as long as STV.....*M. longifuniculata*
3. Club slightly less than 3× as long as wide, F2 1.6× longer than F1, pedicel about 1.5× as long as wide (Fig. 2b); Fore wings with MV longer than STV (Fig. 2e); Mid lobe of mesoscutum about as long as wide, scutellum 1.5× as broad as long..... .....*M. afrangiata*
- Club more than 3× as long as wide; F1 and F2 about sub equal in length; pedicel more than1.5× as long as wide (Fig. 4b); fore wings with MV shorter than STV

(Fig. 4e); Mide lobe ofmesoscutum slightly wider than long, scutellum 1.2× as wide as long.....*M. brevifuniculata*

***Mirufens afrangiata* Viggiani & Hayat (Figs. 2-3)**

Mirufens (*Trachocera*) *afrangiata* Viggiani & Hayat, 1974: 145.

Mirufens albiscutellum Khan & Shafee, 1977: 32. Syn. by Hayat, 2008: 9.

Mirufens magniclavata Khan & Shafee, 1977: 32. Syn. by Hayat, 2008: 9.

Ufens afrangiata (Viggiani & Hayat): Yousuf & Shafee. 1988: 75.

Ufens albiscutellum (Khan &Shafee): Yousuf & Shafee. 1988: 77.

Ufens magniclavata (Khan & Shafee): Yousuf & Shafee. 1988: 80.

Re-description

Female: Body length, 0.59 mm Body dark except head, dorsal and ventral side of mesoscutum and scutellum with bright yellow; ocelli and eyes bright red. Antennae with club bright yellow with some dark infuscation on club segments. Fore wings hyaline except light infuscation beneath PMV; MV distinctly longer than STV. Ovipositor arising from 3rd gaster segment (Fig. 2a).

Head: Antennae (Fig. 2b) with scape about 4× as long as wide (81: 20); pedicel about 1.5× (44: 28) as long as wide; 2 indistinct ring segments present; 2 segmented of funicle (F1 & F2), F1 shorter than F2, F2 with long hairs as the hairs on club segments; club about 2.8× as long as wide (109: 38).

Mesosoma (Fig. 2c, d): Mid lobe of mesoscutum with (2+2) setae, about as long as wide (154: 152); scutellum each with 2+2 setae, about 1.5× as broad as long (126: 84); propodeum longer than dorsellum (30:19). Fore wings (Fig. 2e) hyaline except a light infuscated patch beneath PMV, slightly less than 2× as long as wide (524: 273); ratios of STV: MV: PMV: SMV, 56: 71: 66: 133, MV clearly longer than STV; disc with setae arranged in rows; RS1 with 5 setae; costal cell narrow; marginal fringe absent.

Metasoma: (Fig. 2f) Gaster longer than mesosoma; ovipositor arising from 3rd the level of gaster segment, slightly longer than hind tibia (97: 85).

Male: (Fig. 3a) Body length 0.58 mm, colour dark brown except fronto-vertex pale yellow. Antennae (Fig. 3b) with scape and pedicel same as female; funicle 2-segmented (F1 & F2), F1 slightly longer than F2 (37: 31); Club with 4 segments (C1, C2, C3 and C4), C3 longest (52) and C4 shortest segment. Fore wings (Fig. 3c) similar to female except marginal fringe present. Genitalia (Fig. 3d) with aedeagus clearly longer than apodemes, aedeagus and apodeme together slightly shorter than genital capsule.

Host: *Oxyrachis tarandus,* on *Acacia* sp.; *Oxyrachis tarandus* on *Prosopis juliflora; Parayasa elegantula; Oxyrachis tarandus* on *Mangifera indica; Oxyrachis tarandus* on *Cassia fistula* (New host plant record).

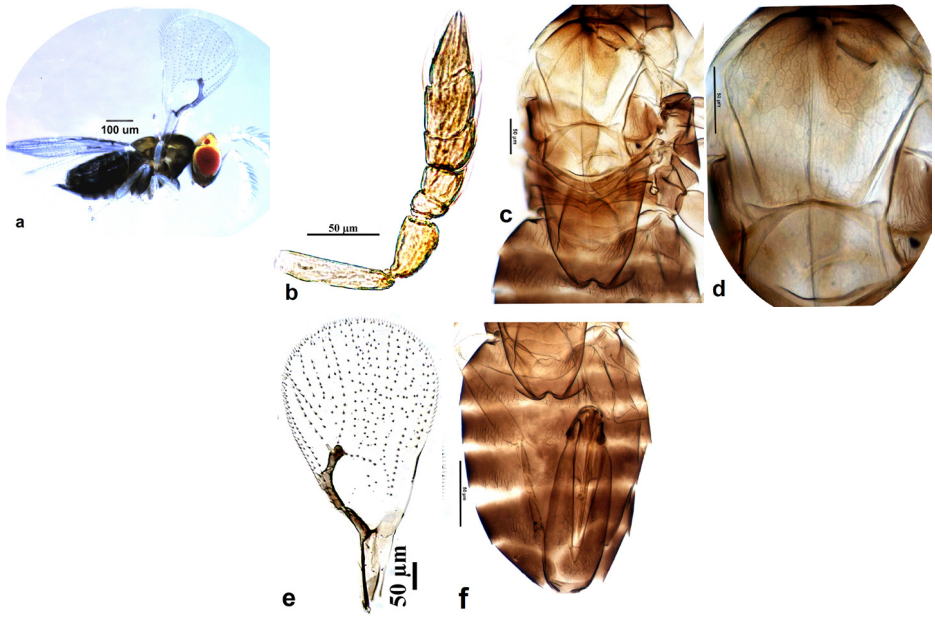

Figure 2. *Mirufens afrangiata* (Female). a) adult, b) antenna, c) mesosoma, d) midlobe of mesoscutum & scutellum (close view), e) fore wing, f) metasoma.

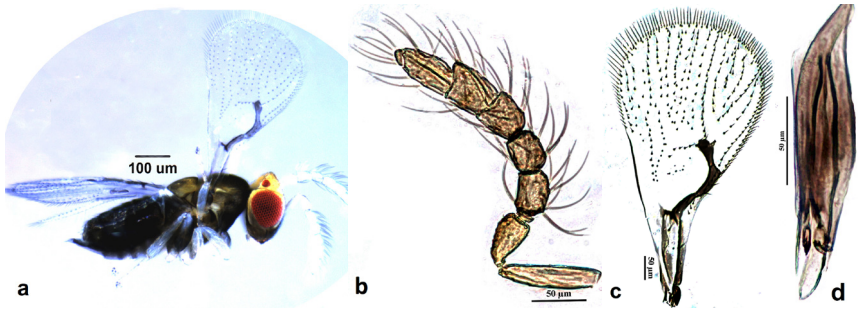

Figure 3. *Mirufens afrangiata* (Male). a) adult, b) antenna, c) fore wing, d) genitalia.

Material examined: INDIA: Uttar Pradesh: Saharanpur, Bahadarpur, 8♀♀ & 3♂♂ (on different slides), 28.06. 2018, M. Ikram; ex. Eggs of *Oxyrachis tarandus* on *Cassia fistula*.

Distribution: INDIA: Rajasthan, Tamilnadu, Uttar Pradesh, Punjab.

***Mirufens brevifuniculata* Khan & Shafee (Figs. 4-5)**

Mirufens brevifuniculata Khan & Shafee, 1977: 32.

Ufens brevifuniculata (Khan & Shafee): Yousuf & Shafee, 1988: 78.

Mirufens brevifuniculata Khan & Shafee: Hayat, 2008: 9.

Re-description

Female: Body (Fig. 4a) length, 0.64 mm. Body dark except head with fronto-vertex bright yellow; ocelli and eyes bright red. Antennae with club pale brown with some dark infuscation on apical segment of club. Fore wings hyaline except light infuscation beneath PMV; MV distinctly shorter than STV. Ovipositor arising from 3rd gaster segment.

Head: Antennae (Fig. 4b) with scape about 4× as long as wide (88: 22); pedicel 1.8× (44: 25) as long as wide; 2 indistinct ring segments present; 2 segments of funicle (F1 & F2), F1 and F2 sub-equal in length, F2 with short hairs; club about 3.4× as long as wide (121: 36), C2 about as long as C3.

Mesosoma: (Fig. 4e) mid lobe of mesoscutum with (2+2) setae, about 1.2× as long as wide (150: 130); scutellum with 2+2 setae, slightly broader than long (123: 101); propodeum longer than dorsellum (38: 22). Fore wings (Fig. 4c) hyaline except a light infuscated patch beneath PMV, slightly more than 2× as long as wide (542: 230); ratios of STV: MV: PMV: SMV, 66: 48: 64: 128, MV clearly shorter than STV (48: 66); disc with setae arranged in rows; RS1 with 3 setae; costal cell broad; marginal fringe absent.

Metasoma: Gaster longer than mesosoma; ovipositor (Fig. 4d) arising from 2nd level of gaster; 1.6× longer than hind tibia (249: 156).

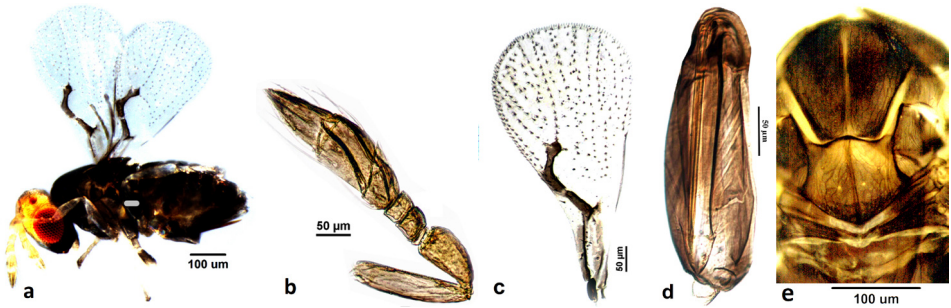

Figure 4. *Mirufens brevifuniculata* (Female). a) adult, b) antenna, c) fore wing, d) ovipositor, e) mesosoma

Male: (Fig. 5a) Body length shorter than female, 0.57 mm, colour dark brown except fronto-vertex and tibia, tarsal segments with pale yellow. Antennae (Fig. 5b) with scape and pedicel same as female; funicle 2-segmented (F1 & F2), F1 about as long as F2 (36: 35); Club with 4 segments (C1, C2, C3 and C4), C3 longest (56) and C4 shortest segment (9).Fore wings (Fig. 5c) similar to female except marginal fringe present. Genitalia (Fig. 5d) with aedeagus slightly shorter than apodemes, aedeagus and apodeme together slightly shorter than genital capsule (164: 141).

Host: *Oxyrachis tarandus,* on *Acacia* sp.; *Oxyrachis tarandus* on *Prosopis juliflora*

Material examined: INDIA, Haryana, Mahendragarh, Narnaul, 1♀ & 2♂♂ (on different slides), 14.07.2018, M. Ikram; ex. Eggs of *Oxyrachis tarandus* on *Prosopis juliflora*.

Distribution: INDIA: Rajasthan, Uttar Pradesh, Haryana (Present Record).

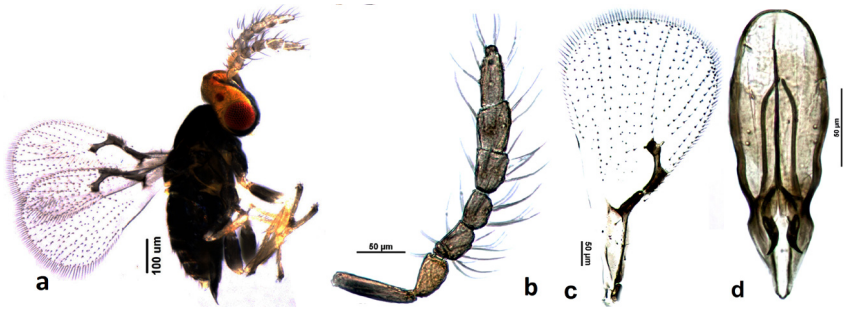

Figure 5. *Mirufens brevifuniculata* (Male). a) adult, b) antenna, c) fore wing, d) genitalia.

DISCUSSION

Oxyrachis tarandus (Hemiptera: Membracidae) is widely distributed in India and adjacent countries. Its nymphs and adults feed gregariously on the sap of the shoot of different host plants such as *Acacia catechu*, *A. nilotica*, *Albizia chinensis*, *A. lebbek*, *Cassia fistula*, *Prosopis juliflora* Yousuf & Gaur (1993). *Mirufens* is important egg parasitoid of insect pest of various hemipterous insects such as *Lapidosaphes ulmi* on *Betula* sp. (Erdos, 1956); *Oxyrachis tarandus* on *Acacia* sp. and *Prosopis juliflora*. *Oxyrachis tarandus* on *Mangifera indica*. So, there was no earlier record of parasitoid *Mirufens* on the eggs of *Oxyrachis tarandus* attacking on *Cassia fistula* but in present study, *Mirufens afrangiata* is being reported for the first time. Earlier worker poorly described and illustrated two species of *Mirufens*; *Mirufens afrangiata* and *Mirufens brevifuniculata* and there was no male record of *Mirufens brevifuniculata*. Thus, both species have been re-described in details with well illustration of different morphometric characters along with a revised key of the Indian species.

Cassia fistula has high medicinal value in different types of traditional medicines including Ayurveda, Unani and Chinese in the treatment and prevention of various diseases. So, It's important to protect this valuable tree from severe infestation of hemipterous insect pest, *Oxyrachis tarandus,* after developing mass multiplication technique of egg parasitoid, *Mirufens afrangiata* can be used as biological control agent for this pest. Re-description and updated key will be helpful in identification for future researchers.

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