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PRESENT STATUS AND KEY TO INDIAN FAIRYFLY GENERA (HYMENOPTERA: MYMARIDAE)

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Indian mymarid genera is updated. Keys to diagnose all the known 10 generic groups and 39 mymarid genera (generic group wise) of India are furnished in accordance with the recent (2021) changes in classification of mymarids.

Keywords: Mymarid; group of genera; key; egg parasitoid; diagnosis.

1. INTRODUCTION

Fairyflies are tiny wasps that play a crucial role in the biomanagement of agriculturally important cicadellids and delphacid insect pests. These are exclusively egg parasitoids till 2006, when Huber et al. [1] recorded *Stethynium ophelimi* Huber and *S. breviovipositor* Huber as larval parasitoids of eucalyptus gall wasp, *Ophelimus maskelli* (Ashmead). Indian mymarid genera can be grouped under 11 groups of genera as per Lin et al. [2]. However, Huber et al. [3] merged the *Anagroidea* group with *Cleruchus* group thereby reducing generic group to 10. Eventhough 116 genera are known globally (Noyes [4]), it is represented only by a meagre 38 genera (Manickavasagam and Athithya [5] and Manickavasagam and Palanivel [6]) representing 10 groups of genera (*Eustochomorpha* and *Borneomymar* group are not reported so far) from India. Subsequently, two genera *viz.*, *Camptopteroides* Viggiani and *Cleruchoides* Lin & Huber were reported from India by Sankararaman et al. [7] and [8] thereby taking the total genera to 40. Due to the status change of *Eofoersteria* Mathot as a subgenus of *Camptoptera* Foerster (Huber et al. [3]), the total genera as of now is 39 from India that is keyed out here to diagnose the generic group first, then the genera from that group rather than using the generic key containing all the genera as a single key.

2. MATERIALS AND METHODS

The specimens were collected through yellow pan traps, sweep net, malaise trap and pit fall traps as described by Noyes [9] and Noyes and Valentine

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[10]). The collected specimens were mounted on cards and then on slides as per Huber [11]. All identified parasitoids' habitus images from card mounted specimens were captured using a Leica M205C stereozoom trinocular microscope with a DMC2900 camera and the slide mounted parts using a DFC295 camera attached to a Leica DM750 phase

contrast microscope. The stacked images were combined using combined Zip software. Except for the genera *Australomymar* Girault and *Tanyxiphium* Huber, all images were taken from the present study. Literature on taxa reported by other researchers were included in the present study.

3. KEY TO MYMARID GROUP OF GENERA AND GENERA OF INDIVIDUAL GROUPS KNOWN FROM INDIA

A. Key to Indian mymarid group of genera

1.	Tarsi 5-segmented (Figs. 12, 18, 35) (except Kikiki, Ptilomymar)2										
-	Tarsi 4-segmented (Figs. 4, 10, 41)										
2.	Funicle 8-segmented (Figs. 35, 44)										
-	Funicle 5-7 segmented (Figs. 5, 12, 16) (except <i>Ptilomymar</i> 7-8 segmented)										
3.	Gaster petiolated; body sclerotized (Fig. 44)1. <i>Ooctonus</i> group (known by 1 genus)										
-	Gaster subsessile; body not sclerotized (Fig.35)										
4.	Marginal vein very long (2/3 of wing length) (Fig. 12)										
-	Marginal vein very short (even less than 1/3 of wing length)										
5.	Mesophragma not projecting into gaster (Figs. 15 & 50); (if funicle 7-segmented, Fl ₂ ring like) (Fig. 16)										
	4. <i>Camptoptera</i> group (Known by 4 genera)										
-	Mesophragma projecting well into gaster (Fig. 5)										
6.	Ovipositor very long with large loop inside gaster (Fig. 57)										
-	Ovipositor slightly long without large loop inside gaster (except Omyomymar)7										
7.	Fore wing narrow with parallel sides (Fig. 21), but sometimes much wider to slightly wider, with										
	diverging sides (Fig. 34); funicle moniliform/submoniliform (Figs. 21, 23, 34) (broader than long, bead										
	like)										
-	Fore wing not narrow without parallel sides (Fig. 46); funicle segments equal or longer than broad (Fig.										
	41, 48)										
8.	Gaster strongly petiolated (Fig. 41, 42)8. <i>Polynema</i> group (Known by 7 genera)										
-	Gaster sessile or subsessile (Figs. 10, 33)										
9.	Mesophragma projecting into gaster (Figs. 10, 58) (except Omvomymar & Dorva)										
	9. <i>Anagrus</i> group (Known by 6 genera)										
_	Mesophragma not projecting into gaster (Figs. 11, 33)										

B. Key to genera of individual group of genera

B 1. *Ooctonus* group (Fig. 44)

This group is known only by single genus in India (1. Ooctonus Haliday)

B 2. Key to the Gonatocerus group of genera

- Dorsellum rhomboidal, triangular or biconvex, usually much less than 5× as wide as long, anterior margin not parallel with posterior margin (Figs. 26, 59, 62); ocellar triangle with two setae

35).....

- 3. Pronotum entire (Fig. 59& 60 After Triapitsyn et al. [12]).....4. Tanyxiphium Huber

- Fore wing wider and bare behind venation (Fig. 25)......6. Cosmocomoidea Howard



Figs. 1-4. Acmopolynema 1. Mesosoma, 2. Antenna, 3. Head, 4. Habitus; 5 & 6. Alaptus Habitus & Fore wing; 7 & 8. Allanagrus Fore wing & Antenna; 9. Anagroidea Habitus; 10. Anagrus Habitus; 11. Anaphes Habitus; 12. Arescon Habitus



Figs. 13 & 14. *Callodicopus* Habitus & Mesosoma; 15 & 16. *Camptoptera* Habitus & Antenna; 17 & 18. *Camptopteroides* Antenna & Habitus; 19. *Cleruchus* Head; 20. *Cleruchoides* Head

B 3. Arescon group (Fig. 12)

This group is known only by single genus in India (7. Arescon Walker).

B 4. Key to the Camptoptera group of genera

1.	Tarsi 4-segmented $(4^{th}\& 5^{th} tarspective and Gt_1)$		si fused); funicle (areolate		7-8 segmented, 2 carinae)		Fl ₂ not ring lipresent		; areola (Fig.	te structure around 50)			
	8. <i>Ptilomymar</i> Annecke & Doutt												
-	Tarsi 5-se 53)	gmented;	funicle	6-7	segmented,	Fl ₂	either	shortest	or	ring 2	like	(Figs.	16,
2.	Presence of with	transluce	nt membr	ane ai	round propo ed mi	deum crotric	& petiol hia	le (Fig. 52 (Fig.	; fo	ore win 54)	g rela	tively bi	road,
	9. Stephanocampta Mathot												
-	Absence of translucent membrane around propodeum & petiole; fore wing somewhat narrow, with only												
	few microtrichia (Fig.15)												

- 3. Fl₂ ring like (Fig.16), fore wing narrow medially, apically curved & hyaline (Fig. 15) (petiole with a lateral flange at about midpoint).....10. *Camptoptera* Foerster
- Fl₂ either ring like or not (Fig. 17), fore wing parallel sided, apically pointed & sharp, no microtrichia on the blade & distinctly with dark areas (Fig.18).....



Fig. 21. Cleruchus Habitus; 22 & 23. Cleruchoides Fore & hind wings and Habitus, 24-26. Cosmocomoidea - 24.Head, 25. Fore wing, 26. Mesosoma; 27 & 28. Dicopus Head & Fore wing; 29 & 30. Dicopomorpha Fore wing & Head

B 5. Key to the Alaptus group of genera

1. Tarsi 3-segmented (Fig. 38) (funicle 4-segmented, clava 2-segmented)..... Mesosoma strongly sculptured (funicle 6-segmented) (Fig. 39)13. Litus Haliday 2. Funicle 5 or 6-segmented (Fig. 5), hind margin of fore wing excised beneath venation (Fig. 6) 3. Funicle 6 or 7-segmented (Fig. 13), hind margin of fore wing convexly rounded, not excised Scutellum not separated into anterior and posterior by change in sculpture (Fig.14) 4.

- - Dicopomorpha Ogloblin

B 6. Australomymar group (Fig. 57 After Narendran et al. [13])

- This group is known only by single genus in India (18. Australomymar Girault).



Fig. 31. Dicopomorpha Mesosoma; 32. Dorya Antenna; 33. Erythmelus Habitus; 34. Eubroncus Habitus; 35. Gonatocerus Habitus; 36. Himopolynema Habitus



Fig. 37. Himopolynema Head; 38. Kikiki Habitus; 39. Litus Habitus; 40. Lymaenon Mesosoma; 41. Mymar Habitus; 42. Narayanella Habitus

B7. Key to the Cleruchus group of genera

- Head not flattened, X-shaped epicranial suture absent; clava entire, fore wing without sharply pointed tip



Fig. 43. Omyomymar Habitus; 44. Ooctonus Habitus; 45. Palaeoneura Habitus; 46. Polynema Habitus; 47. Platystethynium Habitus; 48 & 49. Pseudanaphes Antenna & Fore wing

B 8. Key to the Polynema group of genera

- 1. Fore wing oar shaped, with partly infuscate blade; hind wing filamentous; antennal scape constricted medially; Fl₂ the longest (Fig. 41)24. *Mymar* Curtis

- Propodeum without V shaped carina; scape with imbricate or rasp-like sculpture on inner surface (Fig. 55 & 56); vertex with a wide, shallow depression outside each ocellus; prothoracic spiracle advanced



Fig. 50. *Ptilomymar* Habitus; 51. *Schizophragma* Habitus; 52-54. *Stephanocampta:* 52. Petiole & Metasoma, 53. Antenna. 54. Fore wing; 55 & 56. *Stephanodes* Habitus & Antennal scape; 57. *Australomymar* Habitus

B 9. Key to the Anagrus group genera

- 1. Clava entire (Fig. 10,32)
 2

 Clava segmented (Fig. 43, 58)
 3
- 2. Clava clearly shorter than all funicle segments, evenly wider towards apex; funicle segments longer than wide (Fig. 10); protibial spur comb-like....31. *Anagrus* Haliday

- 5. Clava not compact, with transverse or only slightly oblique, complete and distinct sutures (Fig. 8); fore wing apex pointed (Fig. 7)...35. *Allanagrus* Noyes & Valentine



Fig. 58. Stethynium Habitus; 59 & 60. Tanyxiphium Mesosoma & Habitus; 61-64. Zeyanus. 61. Habitus, 62. Mesosoma, 63. Metasoma, 64. Head

B 10. Key to the Anaphes group of genera

1.	Hypopygium	plough-share	shaped,	funicle	5-6	segmented	(Fig.	33)			
						37. <i>Eryth</i>	melus]	Enock			
-	Hypopygium not ploughshare shaped, funicle 6-segmented										
2.	Fl ₁ shortest;	clava 2-seg	mented;	fore wi	ng b	roader (Fig.	11).				
-	Fl ₁ about equal or sub equal to at least one another funicle segment, clava 3-segmented (Fig. 48), fo										
	wing	much	broader		(Fig.						

4. DISCUSSION

Keys were provided by Annecke and Doutt [14], Subba Rao and Hayat [15], Noyes and Valentine [10], Lin et al. [2] and Huber et al. [3] to identify the mymarid genera directly at various geographical level. However, in all their keys, there is no specific mention of diagnosing the generic groups. Here it is included as the first choice and then to the genera.

5. CONCLUSION

Keys already available to diagnose the Indian genera of mymarids directly deal with genera. Here, a beginner will arrive at generic group first, based on certain common characters and then the genera within that group thereby misidentification can be minimized, apart from understanding the closely related genera. Further the keys are updated with additional generic reports and the status change of *Eofoersteria* is also taken care of.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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