
BIOSYSTEMATIC CHECKLIST OF COMMON MYIASIS CAUSING CALLIPHORIDS AND SARCOPHAGIDS FLIES OF INDIA

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ABSTRACT: Dipterans are a diverse order of insect of which Calliphorids and Sarcophagids are the most ubiquitous, as several species of these families immature stages have been known to cause a deleterious condition of human and animal tissue collectively termed as myiasis. Therefore it is essential to gather information and to setup a biosystematic species inventory on the common and most ubiquitous causers of myiasis, viz the Calliphorids and Sarcophagids of India. Synonyms, notes about type localities, depositories, and distribution are included. The current study reveals, a total of 21 flies are responsible for causing myiasis in India, out of which 9 species belong to the family Calliphoridae and 12 species belong to the family Sarcophagidae, respectively. The present study provides a synopsis of the regional taxonomical work carried out until now, and can serve as a baseline data for future survey studies.

KEYWORDS. Forensic entomology, Myiasis, Calliphoridae, Sarcophagidae, India.

INTRODUCTION

India is one of the world's most biodiverse regions with a total area of about 3,287,263 km². The faunal diversity of India is rich and diversified because of a variety of ecozones ranging from deserts to high mountains and tropical to temperate forests. The Indian myiasis causers, especially the family Calliphoridae and Sarcophagidae has been poorly known as most species were described in the 19th century. Apart from treatment by (Senior-White et al, 1940). This taxonomically and medico legally important fauna have been neglected till date. The study indicates that most of the species have been

collected in selected regions of India, typically from West Bengal.

The term "myiasis," was introduced by Hope in 1840, is now in general use to indicate the condition resulting from the invasion of tissues or organs of man or animals by dipterous larvae. Somewhat earlier, Kirby and Spence had proposed the name "scoleciasis" for such invasions by insect larvae in general. Hope proposed to limit the term "scoleciasis" by proposing "myiasis" for dipteran larvae; "scoleciasis" for lepidopterous larvae and "canthariasis" for coleopteran larvae⁸.

Patton in 1921 extended the use of the term myiasis to include all stages of Diptera including that eggs, pupae, and even adults may occasionally be found in the human or animal body. Thus the need for a species inventory or a general guide to the subject became evident, only after the progress of World War II in Europe and America^{9,10}.

The family Calliphoridae and Sarcophagidae flies are the most ubiquitous due to their trademark appearance on wounds and dead bodies. The family Calliphoridae is represented currently in the world by 1,520 species and out of which 59 species is found in India and the family Sarcophagidae is represented currently in the world by 3,079 species and out of which 126 species are found in India^{11,12}.

Therefore the current study focuses on the generation of base line data for India, which is so far not been attempted yet and this will seemingly be the pioneering study to generate a species inventory of myiasis causing Calliphorids and Sarcophagids of India, also synonyms are given to avoid misidentification and distribution is given in this biosystematic checklist.

MATERIALS AND METHODS

Status survey

Taxonomic nomenclature used for the checklist follows (Evenhuis, 2014). Indian distribution and elsewhere are also given; along with synonyms of the species. The study is based on the available literature rather than on extensive new taxonomic work. Most of the names of the described

species presented are in accordance with the most recent Stratiomyidae classification following Systema Dipteroorum (Woodley, 2001 and Pape and Evenhuis, 2013).

Museum survey

Dipterans collected from carcasses (adult or immature); were listed and surveyed from National Zoological Collection and General Diptera collection of Zoological survey of India.

Literature survey

Taxonomic literatures were reviewed for extracting out Indian species of the forensically important dipteran from internet resources and other relevant literatures such as Catalog of Life (updated on September, 2016)¹, Systema Dipteroorum (updated on June, 2013)², Catalog of fossil diptera (updated on January, 2015)³, Oriental catalog^{4,5} and Catalog of Diptera from Australasian and Ocenian regions⁶, Zoorecords series (2011 to 2016) and State fauna series and Open search for papers on forensic dipterans and allied disciplines from the Internet, were consulted for extraction of the current taxonomic position of the forensically important species, for the preparation of Morphotaxonomic description and proper in-hand identification of the specimens, their biogeographic distribution and ultimately curving all these data into the first of its kind checklist of Indian dipteran species of forensic interest, specially mention the species of West Bengal. Besides this other major contributors of the field along with

their contributions are cited and current status of the Indian variety is elucidated.

Descriptive statistics

Basic Numerical taxonomy is a classification system in biological systematics which deals with the grouping by numerical methods of taxonomic units based on their character states. It aims to create a taxonomy using numeric algorithms like cluster analysis rather than using subjective evaluation of their properties. This is achieved by dividing on criteria basis and utilizing graphs to visualize data [7].

RESULTS AND DISCUSSION

The list is arranged systematically to subfamily level and alphabetically thereafter, to make the search easier for a given taxon. Main references to the original description and distributions are listed. The acronyms used for collections follow the standard of the Systema Dipteriorum (Woodley, 2001 and Pape and Evenhuis, 2013), and their equivalents are: MNHNP—Museum National d'Histoire Naturelle, Paris, France; LSL — Linnean Society of London, London, U.K. , NMW—Naturhistorisches Museum, Vienna, Austria; UZMC—Universitetets Zoologiske Museum, Copenhagen, Denmark; USNM—National Museum of Natural History, Washington, DC, USA.

CHECKLIST OF FORENSIC FLIES OF INDIA

(BASED ON IMMATURE STAGE DEVELOPMENT MODEL)

ORDER Diptera (Linnaeus, 1758)

SUBORDER Brachycera (Macquart, 1834)

INFRAORDER Muscomorpha (Woodley, 1989)

SECTION Schizophora (Becher, 1882)

SUB SECTION Calyptratae (Robineau-Desvoidy, 1830)

SUPER FAMILY Oestroidea (Leach, 1815)

FAMILY Calliphoridae (Brauer & Bergenstamm, 1889)

SUB FAMILY Calliphorinae Brauer & Bergenstamm 1889

TRIBE Calliphorini Lopes, 1968

GENUS *Calliphora* Robineau-Desvoidy

SUB GENUS *Calliphora* Robineau-Desvoidy, 1830

CALLIPHORA Blainville, 1826: 11. *Nomen nudum*.

CALLIPHORA Robineau-Desvoidy, 1830: 433. Type species: *Musca*

vomitorea Linnaeus, 1758, orig. des.

MYA Rondani, 1850b: 175. Type species: *Musca vomitorea* Linnaeus, 1758, orig. des. [Preocc. Linnaeus, 1758.]

SOMOMYA Rondani, 1861b:9 (n. n. for *Mya*).

SUB GENUS CALLIPHORA Robineau-Desvoidy, 1830: 433 (as gen.). Type species: *Musca vomitorea* Linnaeus, 1758, orig. des

1. *Calliphora (Calliphora)*

vicina Robineau-Desvoidy, 1830.

TL: USA. Louisiana (T A MNHNP). Robineau-Desvoidy, J. B. 1830. Essai sur les myodaires. Mem. Pres. Div. Sav. Acad. Sci. Inst. Fr. 2(2), 813 pp. [1830.06.30]

Distribution in India: Himachal Pradesh (Shimla), Jammu & Kashmir (Jammu), Meghalaya (Khasi hills), Sikkim (Gangtok, Mangan, Phensang, Tadong), Tamil Nadu (Chennai), Uttar Pradesh (Agra), Uttaranchal (Dera dun, Mussorie, Nainital), West Bengal (Alipurduar, Birpara, Darjeeling, Ghoramara isl., Kalimpong, Kolkata, Kurseong, Rajabhatkhawa).

Host: Sheep (5).

2. *Calliphora (Calliphora) vomitoria* (Linnaeus, 1758)

TL: Sweden (T A LSL).Linnaeus, C. 1758. Systema naturae... Ed. 10, Vol. 1. 824 pp. L. Salvii, Holmiae [= Stockholm]. [1758.01.01]

Synonyms

Calliphora affinis Macquart, 1835
Calliphora fulvibarbis Robineau-Desvoidy, 1830
Calliphora pseudovomitoria Baranov, 1943
Calliphora rubrifrons Townsend, 1908
Musca carnivora Fabricius, 1794
Musca coerulea De Geer, 1776
Musca minimus Harris, 1780
Musca obscoena Eschscholtz, 1822

Distribution in India: Western Himalayas; Himachal Pradesh (Shimla), West Bengal (Darjeeling, Senchal lake area, Sukna forest) and Sikkim (Dentam, Ganktok, Gazeing).

Host: Human (5).

TRIBE Luciliini Shannon 1924 GENUS

***Lucilia* Robineau Desvoidy, 1830**

LUCILIA Robineau-Desvoidy, 1830: 452. Type species: *Musca caesar* Linnaeus, 1758, des. Macquart, 1834b: 162.

PHAENICIA Robineau-Desvoidy. 1863:

750. Type species: *Phaenicia concinna* Robineau-Desvoidy, 1863 [= *Musca sericata* Meigen, 1826], des. Townsend, 1916c: 8.

3. *Lucilia cuprina* (Wiedemann, 1830).

TL: China. Wiedemann, C. R. W. 1830. Ausereuropaische zweifflugelige Insekten. Zweiter Theil. Schulz, Hamm. xii + 684 pp., 5 pls. [1830.09.22]

Synonyms

Lucilia amica Robineau-Desvoidy, 1830
Lucilia argyricephala Macquart, 1846
Lucilia dorsalis Robineau-Desvoidy, 1830
Lucilia elegans Robineau-Desvoidy, 1830
Lucilia leucodes Frauenfeld, 1867
Lucilia nigricornis Senior-White, 1924
Lucilia pseudosericata Gaminara, 1930
Lucilia pubens Macquart, 1843
Lucilia usta Robineau-Desvoidy, 1830
Musca fucina Walker, 1849
Musca serenissima Walker, 1853
Musca temperata Walker, 1853
Musca varians Wiedemann, 1830
Phaenicia pallescens Shannon, 1924
Somomya pallifrons Bigot, 1877
Strongyloneura nigricornis Senior-White, 1924

Distribution in India: West Bengal (Alipurdaur, Jaigoan, Jambu isl., Kalyani, Rajabhatkhawa, Ranaghat, Sagar ils., Sealdah, Beliaghata, Kolkata).

Host: Sheep (5).

4. *Lucilia illustris* (Meigen, 1826).

TL: Germany. Hamburg [not given]. Meigen, J. W. 1826. Systematische Beschreibung der bekannten europaischen zweifflugeligen

Insekten. Funfter Theil. Schulz-Wundermann, Hamm. xii + 412 pp. [after 1826.08.01, preface date].

Distribution in India: Sikkim (Jorethang), Karnataka (Mysore), West Bengal (Darjeeling, Jalapahar, Jalpaiguri, Kolkata, Senchal Lake area, Silliguri).

Host: Humans and Foxes (5).

5. *Lucilia sericata* (Meigen, 1826).

TL: Austria (T A NMW). Meigen, J. W. 1826. Systematische Beschreibung der bekannten europaischen zweiflugeligen Insekten. Funfter Theil. Schulz-Wundermann, Hamm. xii + 412 pp. [after 1826.08.01, preface date]

Synonyms

Pyenonesia sericata (Meigen, 1826).

Lucilia barberi Townsend, 1908

Lucilia capensis Robineau-Desvoidy, 1830

Lucilia flavipennis Macquart, 1843

Lucilia frontalis Brauer & Bergenstamm, 1891

Lucilia giraulti Townsend, 1908

Lucilia lagyra Walker, 1849

Lucilia latifrons Schiner, 1861

Lucilia pruniosa Meigen, 1838

Lucilia sayi Jaennicke, 1867

Musca lagyra Walker, 1849

Musca nobilis Meigen, 1826

Musca tegularia Wiedemann, 1830

Phaenicia concinna Robineau-Desvoidy, 1863

Distribution in India: Himachal Pradesh, Maharashtra and West Bengal (Bamankhali, Darjeeling Ghoramara isl., Kalingpong, Malda, Siliguri, Sukana forest, Takvar).

Host: Sheep (5). **SUB FAMILY**

Chrysomyinae Roback, 1951

TRIBE Chrysomyini Shannon 1923

GENUS *Chrysomya* Robineau-Desvoidy, 1830

CHRYSOMYA Blainville, 1826: 11. *Nomen nudum*.

CHRYSOMYA Robineau Desvoidy, 1830: 444. Type species: *Chrysomya*

regalis Robineau-Desvoidy, 1830, des.

Coquillett, 1910: 523.

CHRYSOMYIA Agassiz, 1847: 85 (unjust. emend. of *Chrysomya*).

COMPSOMYIA Rondani, 1875b: 425. Type species: *Musca dux* Eschscholtz, 1822

[= *Musca megacephala* Fabricius, 17941, des. Coquillett, 1910: 526.

MICROCALLIPHORA Townsend, 1916a: 618. Type species: *Lucilia varipes* Macquart, 1851, orig. des.

PSILOSTOMA Surcouf, 1920: 58. Type species: *Chrysomyza incisuralis* Macquart, 1850, orig. des.

ACHOETANDRUS Bezzi, 1927b: 235 (*Chrysomya* subg.). Type species: *Musca albiceps* Wiedemann, 1819, orig. des.

EUCOMPSOMYIA Malloch, 1927e: 325. Type species: *Eucompsomyia*

semimetallica Malloch, 1927, orig. des.

CEYLONOMYIA Fan, 1965: 196. Type species: *Chrysomyia nigripes* Aubertin, 1932, orig. des.

ACHAETANDRUS, error for *Achoetandrus*

6. *Chrysomya albiceps* (Wiedemann, 1819).

TL: South Africa. Cape of Good Hope (T F NMW). Wiedemann, C. R. W. 1819. Beschreibung neuer Zweiflugler aus Ostindien und Afrika. Zool. Mag. (Wiedemann's) 1(3): 1-39. [1819.??.]

Synonyms

Chrysomyia indica Patton, 1934
Compsomyia flaviceps Seguy, 1927
Compsomyia mascarenhasi Seguy, 1927
Lucilia arcuata Macquart, 1851
Lucilia testaceifacies Macquart, 1851
Musca bibula Wiedemann, 1830
Musca elara Walker, 1849
Musca emoda Walker, 1849
Musca felix Walker, 1853
Musca himella Walker, 1849
Paracompsomyia verticalis Adams, 1905
Somomyia annulata Brauer, 1899
Somomyia arussica Corti, 1895
Somomyia nubiana Bigot, 1877

Distribution in India: Punjab (Lyallpur) and eastwards to north-west India.

Host: Bovine (Bull) (5).

7. *Chrysomya bezziana* Villeneuve, 1914.

TL: Africa .Villeneuve, J. 1914. Etude sur quelques types de Myodaires superieurs. Revue zool. afr. 3: 429-441

Distribution in India: Assam (Tezpur), Arunachal Pradesh (Dunn Bridge, Tipi), Bihar (Pusa) and West Bengal (Budge Budge, Burdwan, Kolkata, Shibpur botanical garden).

Host: Human and Bovine (5).

8. *Chrysomya megacephala* (Fabricius, 1794).

TL: Ghana. Teshi [as "Guinea"] (ST A UZMC). Fabricius, J. C. 1794. Entomologia systematica emendata et aucta. Vol. 4, [6] + 472 + [5] pp. C. G. Proft, Hafniae [=Copenhagen]. [1794.??.]

Synonyms

Chrysomya megacephala (Fabricius, 1794).
Pyenosonia flaviceps (Berg)
Lucilia flaviceps Macquart, 1843
Chrysomya duvaucelii Robineau-Desvoidy, 1830
Chrysomya gratiosa Robineau-Desvoidy, 1830
Lucilia flaviceps Macquart, 1843
Musca bata Walker, 1849
Musca combrea Walker, 1849
Musca dux Eschscholtz, 1822
Musca remuria Walker, 1849
Pollenia basalis Smith, 1876
Somomya cyaneocincta Bigot, 1888
Somomya pfefferi Bigot, 1877
Somomya cyaneocincta Bigot, 1887
Somomya dives Bigot, 1887
Somomya saffrana Bigot, 1877

Distribution in India: Andaman & Nicobar isl., (Port Blair), Arunachal Pradesh (Hornbill, Ranga Para, N. E. F. A, Kameng, N. E. F. A. Missamari, N. E. F. A.), Assam (Chardaur, Jairampur, Lekhabali, Sonai Rupai forest), Bihar (Pusa, Chotanagpur), Jharkhand (Mandar), Lakshadweep (Kavarti), Meghalaya (Cherrapunji), Odhisa (Hirakud, Sambalpur), Sikkim (Jorethang, Namchi), Tamil Nadu (Coromandel), Tripura (Birchandra nagar, Kanthal chhari, Sabru, Sonamura). Uttar Pradesh (Benares),

Uttaranchal (Risikesh, Pashulok, Dera dun) and West Bengal (Aliporedaur, Bally, Barrackpore, Beliaghata, Bijabari, Canning, Daimond harbor, Digha, Jaigon, Jayanti, Kalyani, Kolkata, Kharagpur, Kurseong, Malda, Midnipore, Sagar isl., Sealdah, Shibpur, Singla bazaar, Siliguri, Sukana forest, Darjeeling, Titagarh).

Host: Animal, generally canine and Humans (5).

9. *Chrysomya rufifacies* (Macquart, 1843).

TL: Australia (T M not given). Macquart, P. J. M. 1843. Dipteres exotiques nouveaux ou peu connus. Tome deuxieme.--3e partie. Roret, Paris. 304 pp., 36 pls. [before 1844.02.??]

Distribution in India: Andaman & Nicobar isl. (Port Blair), Jharkhand (Karu), Pondicherry (Aurovil), Sikkim (Jorethang), West Bengal (Alipurdaur, Barrackpore, Bikanbari, Jaigoan, Kalyani, Kurseong, Madarihat, Panighat, Panitanki, Rajabhatkhawa, Ranaghat, Sagar isl., Sealdah, Shibpur, Singla bazaar, Siliguri) and all over India.

Host: Human and Sheep (5).

SUBORDER Brachycera (Macquart, 1834)

INFRAORDER Muscomorpha (Woodley, 1989)

SECTION Schizophora (Becher, 1882)

SUB SECTION Calyptratae (Robineau-Desvoidy, 1830)

SUPER FAMILY Oestroidea (Leach, 1815)

FAMILY Sarcophagidae Halidav. 1853

GENUS *Wohlfahrtia* Brauer & Bergenstamm, 1889

WOHLFAHRTIA (Wiedemann, 1830).

Type Species: *Sarcophila magnifica* Schiner (SD) Brauer 1893: 501 Brauer, F. & Bergenstamm, J. E. von 1889. Die Zweiflugler des Kaiserlichen Museums zu Wien. IV. Vorarbeiten zu einer Monographie der Muscaria Schizometopa (exclusive Anthomyidae). Pars I. Denkschr. Akad. Wiss. Wien 1889 56 (1): 69-180, 11 pls. [1889.03.??].

10. *Wohlfahrtia nuba* (Wiedemann, 1830)

TL: Sudan. [as "Nubien"] .Wiedemann, C. R. W. 1830. Aussereuropaische zweiflugelige Insekten. Zweiter Theil. Schulz, Hamm. xii + 684 pp., 5 pls. [1830.09.22]

Synonyms

Tachina nuba Wiedemann, 1830

Wohlfahrtia volucris Seguy, 1941

Wohlfahrtia nuba Rohdendorf, 1956

Distribution India: Rajasthan (Bikaner), Punjab.

Host: Human and animals (12).

GENUS *Ravinia* Robineau-Desvoidy, 1863

Type species: *Sarcophaga haematodes* Meigen, 1826 [= *Musca pernix* Harris, 1780], orig. des.

CHAETORAVINIA Townsend, 1917c: 190.

Type species: *Helicobia quadrisetosa* Coquillett, 1901 [= *Sarcophaga derelicta* Walker, 1852], orig. des.

anandra Dodge, 1956: 187 (*Chaetoravinia*). USA; Hawaiian Is.

anxia Walker, 1849: 818. "North America"; Hawaiian Is [introduced]; Bermuda, Canada, Mexico, USA.

pallinervis Thomson, 1869: 535 (*Sarcophaga*). Hawaiian Is. *lherminierii*, authors, not Robineau-Desvoidy, 1830, misid.

SUB GENUS *Squamatodes* Curran, 1927

11. *Ravinia (Squamatodes) pernix* (Harris, 1780)

TL: England. Harris, M. 1776-1780. An exposition of English insects ... Decad I, pp. 1-40, 2 pls. + pls. 1-10 [1776.??.?]; Decad II, pp. 41-72, pls. 11-20 [1778.??.?]; Decads III, IV, pp. 73-99, 100-138, pls. 21-30, 31-40 [after 1779.12.24]; Decad V, pp. 139-166, pl

Synonyms

Ravinia pernix (Harris, 1780)

Sarcophaga haematodes Meigen, 1826

Distribution India: Andhra Pradesh, Arunachal Pradesh (Dunn Bridge), Bihar (Postoita), Himachal Pradesh (Chamba, Dalhousie, Kufri, Manali, Manikaran, Shimla), Jammu and Kashmir (Jhelum valley, Kogyar, Tangmarg), Uttarakhand (Badrinath, Mussoorie, Naini Tal, Sahastradhara, Tehri), West Bengal (Darjeeling, Jaldapara, Takvar Tea Estate).

Host: Birds and Mammals (12).

SUB FAMILY Sarcophaginae Schiner 1861

GENUS *Sarcophaga* Meigen, 1826

SUB GENUS *Bellieria* Robineau-Desvoidy 1863

12. *Sarcophaga (Bellieria) melanura* Meigen, 1826

TL: Europe [from title] (T M MNHNP). Meigen, J. W. 1826. Systematische Beschreibung der bekannten europaischen zweiflugeligen Insekten. Funfter Theil. Schulz-Wundermann, Hamm. xii + 412 pp. [after 1826.08.01, preface date]

Synonyms

Sarcophaga melanura Meigen, 1826

Distribution India: Bihar, Jammu and Kashmir, Tamil Nadu.

Host: Birds and Mammals (12).

SUB GENUS *Bercaea* Robineau-Desvoidy, 1863

Type species: *Musca haemorrhoidalis* Fallén, 1817 [preocc., = *Sarcophaga cruentata* Meigen, 1826], orig. des.

COPROSARCOPHAGA Rohdendorf, 1937: 293 (as gen.). **Type species:** *Musca haemorrhoidalis* Fallén, 1817 [preocc., = *Sarcophaga cruentata* Meigen, 1826], orig. des. africa Wiedemann, 1824: 49 (*Musca*). South Africa; Australia (NSW), Easter I, Hawaiian Is; nearly cosmopol. *cruentata* Meigen, 1826: 28. Not given [Germany]. *haemorrhoidalis*, authors, not Fallén, 1817, misid.

13. *Sarcophaga (Bercaea) africa* (Wiedemann, 1824)

TL: South Africa. Wiedemann, C. R. W. 1824. ... Analecta entomologica ... Regio Typographeo scholarum, Kiliae [=Kiel]. 60 pp., 1 pl. [1824.??.?]

Synonyms

Bercaea haemorrhoidalis Fallén, 1810

Sarcophaga haemorrhoidalis Fallén, 1817

Sarcophaga africa Wiedemann, 1824

Sarcophaga cruentata Meigen, 1826

Bercaea cruentata Meigen, 1826

Musca haemorrhoidalis Meigen, 1826

Distribution India: Assam, Arunachal Pradesh, Himachal Pradesh, Jammu and Kashmir, Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Uttar Pradesh, West Bengal, Bihar (Several localities), Punjab.

Host: Human (12).

SUB GENUS *Liopygia* Enderlein, 1928

Type species: *Musca ruficornis* Fabricius, 1794, orig. des. Enderlein, G. 1928. Klassifikation der Sarcophagiden. Sarcophagiden-Studien I. Arch. Klass. Phylog. Ent. 1: 1-56. [1928.01.31]

JANTIA Rohdendorf, 1937: 251 (*Parasarcophaga* subg.). Type species: *Sarcophaga securifera* Villeneuve, 1908 [= *Sarcophaga crassipalpis* Macquart, 1839], orig. des.

THOMSONEA Rohdendorf, 1937: 247 (*Parasarcophaga* subg.). Type species: *Sarcophaga barbata* Thomson, 1869 [= *Myophora argyrostoma* Robineau-Desvoidy, 1830], orig. des.

14. *Sarcophaga (Liopygia) argyrostoma* (Robineau-Desvoidy, 1830)

TL: South Africa. Cape Province (T A MNHNP). Robineau-Desvoidy, J. B. 1830. Essai sur les myodaires. Mem. Pres. Div. Sav. Acad. Sci. Inst. Fr. 2(2), 813 pp. [1830.06.30].

Synonyms

Sarcophaga barbata Thomson, 1869

Distribution India: Gujrat (Girner hills, Junagadh), Harayana (Ambala), Rajasthan (Jaipur) and Uttar Pradesh (Mussoorie), Punjab (Kalash Valley, Ambala).

Host: Human & sheep (12).

15. *Sarcophaga (Liopygia) ruficornis* (Fabricius, 1794)

TL: India. Tamil Nadu: Tharangambadi [11.03 N 79.84 E] [as "India orientali"]. Fabricius, J. C. 1794. Entomologia systematica emendata et aucta. Vol. 4, [6] + 472 + [5] pp. C. G. Proft, Hafniae [=Copenhagen]. [1794.??.]

Synonyms

Parasarcophaga ruficornis (Fabricius, 1794)

Distribution India: Andhra Pradesh, Assam, Bihar, Delhi, Meghalaya, Mizoram, Goa, Gujrat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Nagaland, Orissa, Punjab, Rajasthan, Tamil Nadu (Tharangambadi [11.03 N 79.84 E]), Uttar Pradesh, West Bengal and Union territories of Andaman and Nicobar Isl. Dadra and Nagar Haveli, Delhi, Lakshdweep and Pondicherry.

Host: Human and Dog & Poultry, *Bufo melanostictus* (12).

SUB GENUS *Liosarcophaga* Enderlein, 1928

Type species: *Cynomyia madeirensis* Schiner, 1868, orig. des. Enderlein, G. 1928. Klassifikation der Sarcophagiden. Sarcophagiden-Studien I. Arch. Klass. Phylog. Ent. 1: 1-56. [1928.01.31]

CURRANEA Rohdendorf, 1937: 255 (*Parasarcophaga* subg.). **Type species:**

Sarcophaga beckeri Villeneuve, 1908 [= *Sarcophaga tibialis* Macquart, 1851], orig. des.

16. *Sarcophaga (Liosarcophaga) dux*
Thomson, 1869

TL: USA. Hawaii: Oahu. Thomson, C. G. 1869. Diptera. Species nova descripsit. Pp. 443-614, In Kongliga svenska fregatten Eugenes resa omkring jorden under befäl af C. A. Virgin, 1851-1853. 2 (Zoologi) 1, Insecta. P. A. Norstedt & Soner, Stockholm. 617 pp., pl. 9.

Synonyms

Sarcophaga dux. var harpax Pandelle, 1896

Sarcophaga subtuberosa Parker, 1917

Distribution India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Delhi, Jammu and Kashmir, Goa, Gujarat, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal and the union territories of Andaman and Nicobar Isl. and Lakshadweep.

Host: Human and Bovine (Cows, Camels and Bullocks) (12).

SUB GENUS *Parasarcophaga* Johnston & Tiegs, 1921

Type species: *Sarcophaga omega* Johnston & Tiegs (MO) = *Sarcophaga taenionota* Wiedemann (SD). Johnston, T.H. and Hardy, G.H. (1923) A revision of the Australian Diptera belonging to the genus *Sarcophaga*. Proceedings of the Linnean Society of New South Wales 48, 94–129. Available from: <http://biostor.org/86267>.

17. *Sarcophaga (Parasarcophaga) albiceps* (Meigen, 1826)

TL: Europe [probably Germany]. Meigen, J. W. 1826. Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten. Funfter Theil. Schulz-Wundermann, Hamm. xii + 412 pp. [after 1826.08.01, preface date]

Distribution India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Delhi, Goa, Gujrat, Harayana, Himachal Pradesh; Kullu; 6,000ft, Mizoram, Nagaland, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal, Andaman and Nicobar, Delhi, Karnataka, Kerala, Madhya Pradesh, Manipur, Maharashtra, Orissa, Panjab, Chandighar, Daman Diu, Pondicherry.

Host: Bovine (Bull) (12).

18. *Sarcophaga (Parasarcophaga) hirtipes* (Wiedemann, 1830)

TL: Egypt. Wiedemann, C. R. W. 1830. Aussereuropäische zweiflügelige Insekten. Zweiter Theil. Schulz, Hamm. xii + 684 pp., 5 pls. [1830.09.22]

Synonyms

Sarcophaga hirtipes. var orchidea Bottcher, 1913

Distribution India: Andhra Pradesh, Bihar, Delhi, Gujrat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Andaman isl.

Host: Human and cattle (sheep) (12).

19. *Sarcophaga (Parasarcophaga) macroauriculata* (Ho, 1932)

TL: China. Jehol, Hung Sung Keng . Rohdendorf BB (1966) Sarcophagidae. Diptera from Nepal. Bulletin of the British Museum (Natural History) Entomology 17: 457-464. Retrieved from <http://biostor.org/86003>.

Distribution India: Manipur (Churachandpur, Imphal, Mao), Meghalaya (Cherapunji), Nagaland (Dimapur), Sikkim (Dentam, Gangtok, Kabi, Chulung, Phensang, Swistik camp), Uttar Pradesh (Kaushani) and West Bengal (Darjeeling).

Host: Human and leopard (12).

20. *Sarcophaga (Parasarcophaga) misera* (Walker, 1849)

TL: Australia [as "New Holland"] .Walker, F. 1849. List of the specimens of dipterous insects in the collection of the British Museum. Part II, [iii]+231-484. [1849.04.21]; Part III: [iii]+ 485-687. [1849.06.30]; Part IV. Pp. [3] + 689-1172 + [2] [1849.12.08] British Museum (Natural History).

Distribution India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Delhi, Goa, Gujrat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal.

Host: Human and Domesticated & Poultry animals, sheep (12).

SUB GENUS *Prionophalla* Rohdendorf, 1963

Type species: *Sarcophaga musprattianus* Zumpt (OD) = *Sarcophaga langi* Curran

(SD).Curran, C. H. 1934. The families and genera of North American Diptera. Ballou Press, New York. 512 pp. 2 pls. [1934.08.25]

21. *Sarcophaga (Prionophalla) peregrina* (Robineau-Desvoidy, 1830)

TL: Australia (T USNM). Robineau-Desvoidy, J. B. 1830. Essai sur les myodaires. Mem. Pres. Div. Sav. Acad. Sci. Inst. Fr. 2(2), 813 pp. [1830.06.30].

Synonyms

Sarcophaga fuscicauda Bottcher, 1912

Sarcophaga hutsoni Parker, 1923

Distribution India: Assam, Bihar, Himachal Pradesh, Kerala, Maharashtra, Madhya Pradesh, Manipur, Mizoram, Nagaland, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal, Andaman and Nicobar Isl. Dadra and Nagar Haveli and Pondicherry.

Host: Human (12).

The current study shows that the genus *Sarcophaga* is the major contributor to myiasis in India, as per previous literatures, as they amount for 48% (10 species) of the myiasis cases in India. The genus *Chrysomya* seems to be 19% (4 species) of the myiasis cases in India, as is the second largest contributor. The genus *Lucilia* amounts for 14% (3 species) of the myiasis cases in India, as is the third largest contributor. The genus *Calliphora* seems to be the fourth largest contributor, with 9% (2 species) of the myiasis cases in India, and the genus *Wohlfahrtia* and *Ravinia* seems to be the fifth largest contributor, with 5% (1 species) each cases of myiasis each in India (Fig.1, 2).

Fig.1: Shows the % of Genus of various flies in their contribution to myiasis cases in India

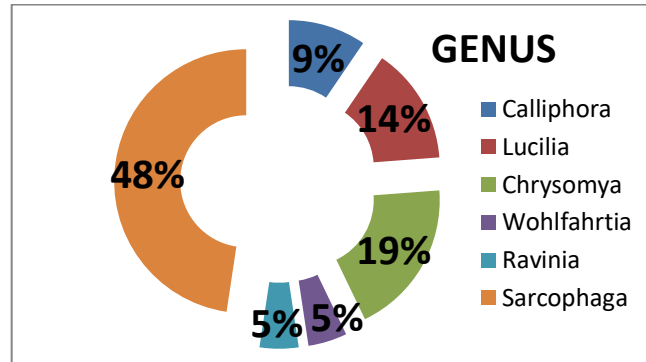


Fig.2: Shows the number of species of Genus of various flies in their contribution to myiasis cases in India

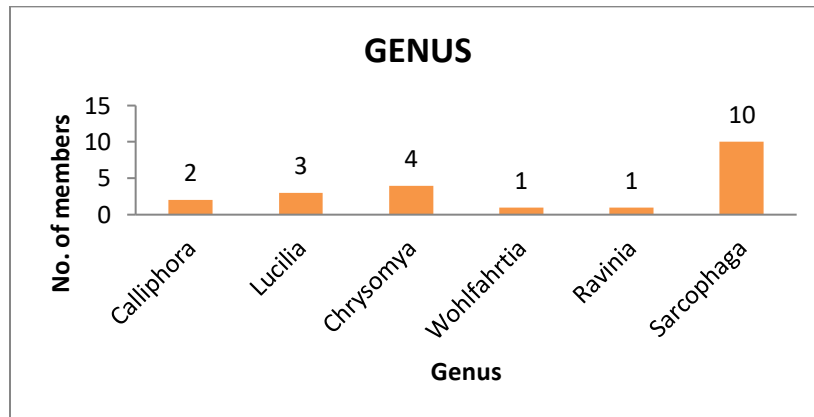


Fig. 3: Shows the % of Genus of various flies in their contribution to myiasis cases in India

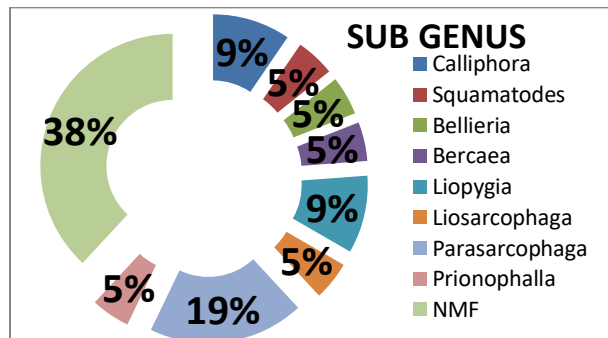
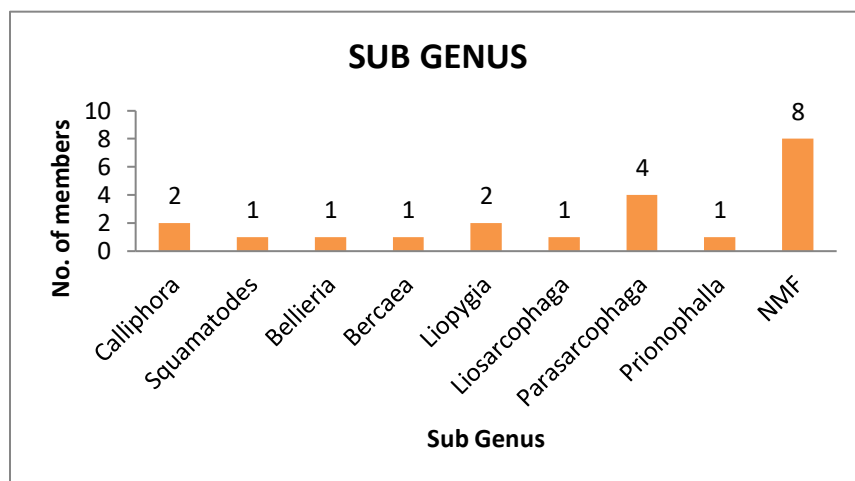


Fig.4: Shows the number of species of Sub genus of various flies in their contribution to myiasis cases in India



The current study shows that the taxonomically less studied species designated as NMF (No mention found) on sub genus is the largest contributor to myiasis in India, with an astounding 38% (8 species), which re establishes the belief that taxonomic study along with biosystematic studies are needed for generation of base line data for these myiasis causing flies. The sub genus Parasarcophaga amounts for 19% (4 species) of the myiasis cases in India, as is the second largest contributor. The sub genus Liopygia and Calliphora amounts for 9% (2 species) each of the myiasis cases in India, as is the third largest contributor. The sub genus Squamatodes, Bellieria, Bercaea, Liosarcophaga and Prionophalla for 5% (1 species) each (Fig.3, 4).

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