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DIPTERA FAUNA OF PUNJAB AND HIMACHAL SHIWALIK HILLS

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INTRODUCTION

The Shiwaliks form the southernmost belt of the Himalayan range (the lower and upper Himalayas being the other two) and have an average elevation of 900–1200 m. At present, the Shiwaliks include the entire southwestern foothills of Himalayas from Indus River in the Northwest to the Brahamaputra River in the Northeast. The Shiwalik eco-region extends from about 29°33' N latitude and 74°80' E longitude. These ranges represent the southern most zone of about 8–40 km width and about 800 km length of Himalayas. The Shiwaliks of Northwest States spread over an area of more than three million hectares and represent most fragile ecosystem of the country. In the north, these hills fall in the districts of Udhampur, Kathua, Jammu and ultimately merging with Reasi and Poonch districts of Jammu & Kashmir. They extend in the southwest to across parts of Chamba, Kangra, Bilaspur, Una, Hamirpur, Solan and Sirmour districts in Himachal Pradesh; Guradaspur, Hoshiarpur, Nawashahar and Roopnagar in Punjab; Union territory of Chandigarh; Ambala, Panchkula, Yamunanagar in Haryana; Dehradun, Haridwar, Udhamsinghnagar in Uttaranchal and Saharanpur and Rampur in Uttar Pradesh. Out of three million hectares, Punjab Shiwaliks accounts for 0.14 million hectares where as Himachal 1.14 million hectares.

The Shiwalik ranges or the outer Himalayas gradually rise from the Indo-Gangetic Plains with a gentle slope of about 3–4 degrees till they touch a rugged topography and bare steep slopes up to an altitude of about 1000 m. In this tract, some hill ranges run roughly parallel to each other for long distances and converge at places, meet and diverge again giving rise to small longitudinal spindle shaped plateau or duns between them. With torrential rainfall during monsoon, the area is subject to soil erosion, hazards due to undulating topography, poor vegetation cover and coarse

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medium texture of sedimentary material. Based on weathering and erosion, two major land forms are of common occurrence in the area besides the hills. The gently roiling, worn out hill lands and the fan shaped deposits at the foot of hills brought about by streams. The lithology of the Shiwaliks suggests that they arc chiefly water worn debris of the granatic core of the central Himalaya, deposited in the long and broad valley of the Shiwalik River (Pilgrim, 1913). Natural vegetation along the foothills of Shiwaliks comprises thorny bushes like *Acacia. Zizyphus.* The Shiwaliks have been identified as one of the eight most degraded rain-fed agro ecosystems of the country. The climate of the Shiwaliks is warming subtropical. It is very hot in summer and markedly cold in winter.

The present study was conducted in the parts of Punjab and Himachal Shiwaliks and resulted in the enumeration of 34 species belonging to 29 genera under 13 families.

SYSTEMATIC ARRANGEMENT OF DIPTERA OF PUNJAB AND HIMACHAL SHIWALIKS

Family TIPULIDAE

1. *Nephrotoma serricornis* (Brunetti)
2. *Conosia irrorata* (Wiedemann)

Family BIBIONIDAE

3. *Plecia (Plecia) dispersa* Hardy

Family TABANIDAE

4. *Hybomitra subcallosa* (Ricardo)
5. *Tabanus (Tabanus) orientis* Walker
6. *Tabanus (Tabanus) oxyceratus* (Bigot)

Family ASILIDAE

7. *Lobus martini* Joseph & Parui
8. *Stichopogon tomentosa* Oldroyd
9. *Michotamia aurata* (Fabricius)
10. *Promachus duvaucelli* (Macquart)

Family BOMBYLIIDAE

11. *Thyridanthrax (Exhyalanthrax) resculus* (Francois)
12. *Exoprosopa (Exoprosopa) insulata* (Walker)

Family SYRPHIDAE

13. *Betasyrphus serarius* (Wiedemann)
14. *Episyrphus balteatus* (De Geer)
15. *Ischiodon scutellaris* (Fabricius)
16. *Melanostoma orientale* (Wiedemann)
17. *Paragus (Paragus) serratus* (Fabricius)
18. *Paragus (Pandasyophthalmus) rufiventris* Brunetti
19. *Messembrius bengalensis* (Wiedemann)
20. *Messembrius quadrivittatus* (Wiedemann)
21. *Syritta orientalis* Macquart
22. *Syritta pipiens* (Linnaeus)

Family CONOPIDAE

23. *Archiconops erythrocephala* (Fabricius)

Family DIOPSIDAE

24. *Diopsis indica* Westwood
25. *Sphyracephala hearseiana* (Westwood)

Family OTITIDAE

26. *Physiphora aenea* (Fabricius)

Family SEPSIDAE

27. *Sepsis rufa* Macquart
28. *Australosepsis frontalis* (Walker)

Family MUSCIDAE

29. *Orthellia timorensis* (Robineau-Desvoidy)
30. *Stomoxys calcitrans* (Linnaeus)

Family CALLIPHORIDAE

31. *Idiella mandarina* (Wiedemann)
32. *Stomorhina discolor* (Fabricius)

Family SARCOPHAGIDAE

33. *Parasarcophaga (Liosarcophaga) dux* (Thomson)
34. *Parasarcophaga (Parasarcophaga) orchidea* (Boettcher)

SYSTEMATIC ACCOUNT

Key to the families

1. Adult antennae having more than 5 segments which are not fused into a solid structure 2
— Adult antennae either fewer than 5 segments (generally 3) or with segments of flagellum fused into a solid structure, and surmounted by a style or arista 3
2. Thorax with a V-shaped suture on mesonotum; ocelli absent ..... TIPULIDAE
— Thorax without V-shaped suture; ocelli present ..... BIBIONIDAE
3. Adult head without a frontal lunule or a ptilinium 4
— Adult head with a distinct frontal lunule and ptilinium 7
4. Wings with a spurious vein between veins R and M; antennal arista usually dorsal ..... SYRPHIDAE
— Wings without any spurious vein; antennal arista, if present, invariably terminal 5
5. Arolium pad-like, nearly or quite as large as two pulvilli; mid tibia invariably with spur ..... TABANIDAE
— Arolium replaced at least by a rudimentary hair-like empodium 6
6. Flies with dense hairs or scales; vertex between eyes a little depressed; proboscis usually long but not adapted for piercing ..... BOMBYLIIDAE
— Flies with long bristles; vertex markedly excavated between eyes; proboscis stout and adapted for piercing ..... ASILIDAE
7. Antennal segment 2 above without a distinct external groove; theca not developed at the base of proboscis 8
— Antennal segment 2 above with a distinct external groove; theca developed at the base of proboscis 11
8. Wing with Cu2 long and reaching or nearly reaching wing margin 9
— Wing with Cu2 short and not reaching wing margin or absent 10
9. Cell Cu2 pointed ..... OTITIDAE
— Cell Cu2 bulbous ..... CONOPIDAE
10. Eyes and antennae carried out on a short or long stalk; scutellum with 2 long spines ..... DIOPSIDAE
— Ant like flies, eyes and antennae normally located; vibrissae present ..... SEPSIDAE
11. Hypopleura without a row of strong bristles below spiracle ..... MUSCIDAE
— Hyplopleura with one or more vertical series of bristles below spiracle 12
12. Arista of antennae pubescent or with feathering not extending much beyond middle; body dull black or striped grey and black ..... SARCOPHAGIDAE
— Arista feathered to tip; body entirely metallic blue or green ..... CALLIPHORIDAE

Family TIPULIDAE

The family Tipulidae is the largest in the Diptera as presently known, with approximately 14000-recorded species in the world. Alexander & Alexander (1973) recorded over 1300 species under 60 genera from India in 'A Catalog of Diptera of the Oriental region'. The members of the family are commonly known as Crane flies or Daddy long-legs. Adults are free living. Their larvae live among decaying vegetation, grass roots, *etc*., or are aquatic. They can be recognised by the long six or more segmented antennae, absence of ocelli, mesotergum with a V-shaped transverse suture, long and slender legs, presence of discal cell, and valvular, horny ovipositor.

Key to the subfamilies

1. Terminal segment of maxillary palpus elongate, with-lash like; nasus usually distinct; antennae usually with 13 segments; wing with Sc_1 usually atrophied, vain cu_1 constricted at m-cu, latter usually at or close to fork of M_{3+4} ..... TIPULINAE

— Terminal segment of maxillary palpus short; nasus not distinct, antennae usually 14 or 16 segments; wing with Sc_1 present, vein cu 1 straight, not constricted at m-cu_1 latter placed for before fork of M_{3+4} ..... LIMONIINAE

Subfamily TIPULINAE

Genus ***Nephrotoma*** Meigen

1803. *Nephrotoma* Meigen, *Magazine, Insektkde,* **2** : 262. Type-species : *Nephrotoma dorsalis* Fabricius.

Diagnosis : Antennae 13 jointed; thorax yellow with black marks; wing with 1 marginal cell, 2 submarginal cells and 5 posterior cells as in *Tipula*, lower branch of fourth longitudinal veins, forks at base of discal cell, normally a little before, so that the posterior cross vein placed exactly at this fork.

1. ***Nephrotoma serricornis*** (Brunetti)

1912. *Pachyrhina serricornis* Brunetti, *Fauna Brit. India Dipt. Nematocera* : 341.

Material examined : 1G, Bella village, Una dist, H.P., 5.iii.2002, Coll. A.R. Lahiri.

Diagnosis : Head lemon yellow to orange yellow with streak on vertex; proboscis yellowish orange; antennae yellowish up to first flagellar joint, rest black; thorax bright chrome-yellow; legs yellow with tips of femora and tarsi narrowly black; wings pale grey; abdomen yellowish with dorsal black stripe composed of elongated spots of each segment.

Distribution : Bihar, Himachal Pradesh, Sikkim and West Bengal. *Elsewhere* : None.

Subfamily LIMONIINAE

Genus ***Conosia*** van der Wulp

1880. *Conosia* van der Wulp, *Tijdschr. Ent.*, **23** : 159. Type-species : *Limnobia irrorata* Wiedemann.

Diagnosis : Occiput produced backward in an obtuse form, the vertical hump also continued backward to the hinder part of head; antennae as long as head, its shape long, thick and cylindrical; pedicel shorter and broader; dorsum of thorax anteriorly produced forward over prothorax; scutellum small; legs long and slender; wing very short compared to abdomen, wing with 2 submarginal cells and 5 posterior cells, third longitudinal vein insinuate, anterior cross vein situated beyond discal cell and posterior cross vein before its middle; abdomen long, 4 times as long as thorax.

2. ***Conosia irrorata*** (Wiedemann)

1828. *Limnobia irrorata* Wiedemann, *Aussereurop. zweifl. Insekt.*, **1** : 574.

Material examined : 2GG, 1E, Bella village, Una dist., H.P., 5.iii.2002, Coll. A.R. Lahiri.

Diagnosis : Antennae with flagellar segment 1 obconical, larger than other segments; wings with subcostal vein ending a little before tip of R_1 vein; discal cell cylindro- conical; anterior branch of M_{1+2} forked half way between discal cell and wing margin.

Distribution : Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Uttar Pradesh and West Bengal.

Elsewhere : Borneo, China, Java, Katosho Island, Malaya, Nepal, Simuulue Island, Sri Lanka, Taiwan; Africa, Australia, Israel, Japan and New Guinea.

Family BIBIONIDAE

The family of “march flies” comprises 39 species under 4 genera of 2 subfamilies in India. Adults often enormously frequent meadows, grassy hillsides or decaying vegetation and predominantly feed on decaying vegetable matter. Larvae are known to feed gregariously on roots and tubers of a wide variety of crops.

Subfamily PLECIINAE

Genus ***Plecia*** Wiedemann

1882. *Pleacia* Wiedemann, *Aussereurop. zweifl. Insekt.*, **1** : 72. Type-species : *Hirtea fulvicollis* Fabricius.

Diagnosis : Antenna normally 12 jointed, may be 10 jointed also with last joint shaped like a flattened core; frons with obtuse ridge; fore femur without spine or teeth; third longitudinal vein forked; fourth longitudinal forked some distance beyond the posterior cross-vein.

3. ***Plecia (Plecia) dispersa*** Hardy

1958. *Plecia dispersa* Hardy, *Pacif. Ins.*, **12** : 196. (n. name *confusca* Malloch).

Material examined : 1♂, Anandpur, Naina Devi Road, Punjab, 22.ix.02, Coll. P. Parui.

Diagnosis : Antennae 12 jointed, reddish brown to black, sometimes this colour varies; proboscis and palpi black with short black pubescence; thorax wholly orange including scutellum; legs black, coxae and trochanters yellowish to brownish yellow; wings pale brown, darker anteriorly; stigma absent; abdomen black with short black pubescence.

Distribution : Andhra Pradesh, Nicobar Islands, Punjab and Tamil Nadu.

Elsewhere : Nepal, Pakistan and Sri Lanka.

Family TABANIDAE

The gnats, horse flies or deer flies as they are commonly known, are haematophagous and some of them are mechanical carriers of Surra, a trypanosomial disease of equines. An extensive family of moderate to large sized flies. They are more or less flattened insects and as a rule, mottled brown, tawny or grey in colour. In India nearly 200 species of 12 genera under 3 subfamilies are reported so far.

Key to the genera

1. Eyes bare ..... ***Tabanus*** Linnaeus
— Eyes hairy ..... ***Hybomitra*** Enderlein

Genus ***Hybomitra*** Enderlein

1922. *Hybomitra* Enderlein, *Mitt. zool. Mus. Berl.*, **10** : 347. Type-species : *Hybomitra solox* Enderlein.

4. ***Hybomitra subcallosa*** (Ricardo)

1911. *Tabanus subcallosa* Ricardo, *Rec. Indian Mus.*, **4** : 227.

Material examined : 1♂, P.W.D. Rest house, Kotari Bangla, Himachal Pradesh, 4.x.2000, Coll. M.L. Thakur & Party.

Diagnosis : Face with white pubescence, forehead with two separate transverse calli; thorax black with grey tomentum and black pubescence; scutellum black with grey tomentum; abdomen with white haired bands on each segment laterally; legs black, tibia yellowish white, black at apices; wings hyaline, sides and base of wing with long white pubescence.

Distribution : Himachal Pradesh and Uttar Pradesh.

Elsewhere : None.

Genus ***Tabanus*** Linnaeus

1758. *Tabanus* Linnaeus, *Syst. Nat. Ed.*, **10** : 601. Type-species : *Tabanus bovinus* Linnaeus.

Subgenus ***Tabanus*** Linnaeus

Diagnosis : Head hemispherical; vertex smoothly flat or slightly concave; postocular ring present; banding on eyes often present; frons usually much narrow; antennal scape rarely as long as wide, hairy.

Key to the species

1. Abdomen black with narrow white haired segmentations and small triangular spots; hind femur with white pubescence, anterior ones with black pubescence ..... *oxyceratus* Bigot

— Abdomen reddish yellow, darker apex, with narrow yellowish white segmentations and median spots; all femora with yellowish white pubescence ..... *orientis* Walker

5. ***Tabanus (Tabanus) orientis*** Walker

1848. *Tabanus orientis* Walker, *List Dipt. Colln. Br. Mus.*, **1** : 152.

Material examined : 2EE, Ramgarh, Punjab, 4.x.2000, Coll. M.L. Thakur & Party.

Distribution : Punjab and Uttar Pradesh.

Elsewhere : China, Myanmar, Nepal, Pakistan, Taiwan and Japan.

6. ***Tabanus (Tabanus) oxyceratus*** (Bigot)

1892. *Atylotus oxyceratus* Bigot, *Mem. Soc. zool. Fr.*, **5** : 652.

Material examined : 1G, 1E, P.W.D. Rest house, Kotari Bangla, Himachal Pradesh, 4.x.2000, Coll. M.L. Thakur & Party.

Distribution : Himachal Pradesh and Uttar Pradesh.

Elsewhere : Myanmar.

Family ASILIDAE

Asilidae (robber flies) is one of the biggest in terms of species and most abundant family of Diptera. They are world wide in distribution and include well over 5000 described species of about 400 genera. Of these only 59 genera over 475 species are known from India and adjacent countries.

Key to the subfamilies

1. Palpus one segmented 2

— Palpus two segmented; first flagellomere spindle shaped with apical microsegment; females usually with circle of spines on acanthophorites ..... DASYPOGONINAE

2. Elongate and excessively slender species; marginal cell open, alula absent; first flagellomere short, ovoid with long bristle-like arista ..... LEPTOGASTERINAE

3. Less slender or robust bristly species, marginal cell closed; first flagellomere long and slender with short bristle bearing microsegment ..... ASILINAE

Subfamily LEPTOGASTERINAE

Tribe LEPTOGASTERINI

Genus ***Lobus*** Martin

1972. *Lobus* Martin, *J. Kansas. ent. Soc.*, **45** : 8. Type-species : *Leptogaster pellipes* Janssens.

Diagnosis : Very narrow elongate flies; first flagellomere short ovoid with a long style-like bristle; alula and pulvilli absent.

7. ***Lobus martini*** Joseph & Parui

1983. *Lobus martini* Joseph & Parui, *Bull. Zool. Surv. India*, **5**(1) : 67.

Material examined : 4E, 2G, Nangal, FRH, Punjab, 23.ix.2002, Coll. A.R. Lahiri.

Diagnosis : Head and antenna black, style of antenna nearly as long as the adjacent segment; thorax black, grey tomentose, hind border with 2 or 3 rows of pale or dark brown short bristles; femora and tibiae pale yellow basally with dark brown apex of varying extent; wing brownish tinged, posterior half lighter than anterior half; abdomen black.

Distribution : Andhra Pradesh, Kerala and Punjab. *Elsewhere* : None.

Remarks : This is the first report of this species from North India (Parui & Mitra, 2004).

Subfamily DASYPOGONINAE

Tribe STICHOPOGONINI

Genus ***Stichopogon*** Loew

1847. *Stichopogon* Loew, *Linn. Ent.*, **2** : 499. Type-species : *Dasypogon elongatulus* Wiedemann.

Diagnosis : Mystax usually of a single row of bristles above epistome; arista bare, first flagellomere short, much shorter than basal two segments together; fourth posterior cell opened.

8. ***Stichopogon tomentosus*** Oldroyd

1948. *Stichopogon tomentosus* Oldroyd, *Entomologist's mon. Mag.*, **84** : 263.

Material examined : 1G, 2E, Ropar, Barmla, Punjab, 27.ix.2002, Coll. A.R. Lahiri.

Diagnosis : Mystax white, antennal scape and pedicel with white bristly ventrally; thorax densely grey tomentose, scutum without usually mediolongitudinal stress; legs orange, fore and hind femora

black dorsally on distal two thirds; wing lightly infuscated and basally hyaline; abdomen dark brown with grey tomentum; female acanthophorites bearing a circlet of 10 spines, lamella without tuft of setae.

Distribution : Andaman Islands, Bihar, Punjab and West Bengal. *Elsewhere* : None.

Subfamily ASILINAE

Key to the tribes

1. Antennal style pulmose ..... **Ommatini**
— Antennal style bare ..... **Asilini**

Tribe **Ommatini**

Genus ***Michotamia*** Macquart

1838. *Michotamia* Macquart, *Dipt. exot.*, **1**(2) : 75. Type-species : *Michotamia analis* Macquart.

Diagnosis : First flagellomere of antenna nearly three times than basal two segments together, arista shorter than first flagellomere and with pectinate hairs clustered at its tip.

9. ***Michotamia aurata*** (Fabricius)

1794. *Asilus aurata* Fabricius, *Ent. Syst.*, **4** : 387.

Material examined : 2G, 3E, Anandpur, Naina Devi Road, Punjab, 22.ix.2002, Coll. P. Parui.

Diagnosis : Mystax yellow, a tuft of yellow hairs on each side of antennae; antennal scape and pedicel yellow, first flagellomere black; scutum black with yellow humeri; abdomen yellow except fifth and sixth segments black, epandrium yellow, broad up to two-thirds and then gradually narrowed towards tip.

Distribution : Andhra Pradesh, Bihar, Delhi, Goa, Karnataka, Kerala, Madhya Pradesh, Orissa, Pondichery, Punjab, Uttar Pradesh and West Bengal. *Elsewhere* : None.

Tribe **Asilini**

Genus ***Promachus*** Loew

1848. *Promachus* Loew, *Linnaeus, Ent.*, **3** : 390. Type-species : *Asilus maculatus* Loew.

Diagnosis : Antennae situated well apart from each others; wing with 3 submarginal cells, radial form shorter than second posterior cell, apex of marginal cell not bulbus as *Philodicus*; in female tenth segment without spine.

10. ***Promachus duvaucelii*** (Macquart)

1838. *Trupanea duvaucelii* Macquart, *Dipt. Exot.*, **1**(2) : 97.

Material examined : 7G, 3E, Dalewal, Kakawal, Hoshiarpur, dist. Punjab, 19.ix.1999, Coll. T.R. Sharma.

Diagnosis : Head yellowish; mystax yellow with a few black hairs on upper part; thorax and scutellum with reddish hairs; legs black, wings yellowish with an obscure streak in the marginal and first submarginal cells; first three abdominal segments with profuse red hairs, male genitalia shining black with concolourous hairs.

Distribution : Delhi, Gujarat, Madhya Pradesh, Punjab, Uttar Pradesh and West Bengal. *Elsewhere* : None.

Family BOMBYLIIDAE

The bombyliids or "bee-flies" are a group of moderate to large sized colourful and beautiful flies of super family Asiloidea under the suborder Brachycera. Knowledge of bee-flies is all the more essential as their larvae are parasitic on bees, fossorial wasps, locusts and sometimes upon noctuid larvae and pupae. Again as their bodies arc clothed with a coat of soft, variegated hair, these flies are of great importance as conveyors of pollen for fertilization of plants. In India, 118 species under 24 genera of 10 subfamilies are so far reported.

Subfamily EXOPROSOPINAE

Diagnosis : Antennae widely separated at base, its style devoid of hairs at tip; metapleuron hairy; prefurca comparatively long, second longitudinal vein originates in the knee-shaped form at approximately opposite anterior cross-vein; squamae with scaly fringe.

Key to the genera

1. Wing with 2 submarginal cells; antennal style not divided by suture from its segment .... ***Thyridanthrax*** Osten-Sacken

— Wing with 3 submarginal cells; antennal style separated by a suture from its segment .... ***Exoprosopa*** Macquart

Genus ***Thyridanthrax*** Osten-Sacken

1866. *Thyridanthrax* Osten-Sacken, *Biologia Cent.-am (Zool)* : 123. Type-species : *Thyridanthrax selene* Osten-Sacken.

Subgenus ***Exhyalanthrax*** Becker

1916. *Exhyalanthrax* Becker, *Annls. Hist.-nat. Mus. natn. Hung.*, **14** : 44. Type-species : *Anthrax vagans* Loew.

Diagnosis : Antennal flagellomere one with apical stripe; pulvilli reduced and rounded in shape.

11. ***Thyridanthrax (Exhylanthrax) resculus*** Francois

1968. *Thyridanthrax (Exhyalanthrax) resculus* Francois, *Bull. Et. Annls Soc. r. ent. Belg.*, **104** : 209.

Material examined : 1G, Koka Hazari, Punjab, 21.ix.2002, Coll. P. Parui.

Diagnosis : Antenne black marked; proboscis blackish brown; occiput black with small yellow scales amid minute white scaly pubescence; thorax blackish covered with very small yellow flat scales extending to the wing base, sides of thorax with small black hairs; scutellum with short flat lying yellow scales and a row of long black bristles; wing with a dark brown oblique band on the anterior margin extending nearly to the costal tip, hind margin clear; abdomen black, segment 7 bears a large fan-shaped bunch of elongate white scales on the anterior corners of the abdomen; genitalia with a circlet of reddish yellow spines.

Distribution : Punjab.

Elsewhere : Taiwan.

Genus ***Exoprosopa*** Macquart

1840. *Exoprosopa* Macquart, *Dipt. exot.*, **2**(1) : 35. Type-species : *Anthrax pandora* Fabricius.

Subgenus ***Exoprosopa*** Macquart

1840. *Exoprosopa* Macquart, *Dipt. exot.*, **2**(1) : 35. Type-species : *Anthrax pandora* Fabricius.

Diagnosis : Marginal cross-vein sinuous and recurrent, R_{2+3} vein opposite or before middle cross vein, posterior cell 1 typically open but sometimes closed; wings never fenestrate, or if so "Window pans" not hyaline; abdomen devoid of silvery bands.

12. ***Exoprosopa (Exoprosopa) insulata*** (Walker)

1852. *Anthrax insulata* (Walker), *Insecta Saundersiana*, **1** : 72.

Material examined : 2E, Barmla, Punjab, 27.ix.2002, Coll. P. Parui.

Diagnosis : Pleuron with dense bristles confined either to lower edge or all over except upper edge : wing mostly clear, with submarginal cells, discal cell typically short and obtuse, upper branch of cubital fork widely divergent; hind tibia usually covered with dense black bristles.

Distribution : Madhya Pradesh, Meghalaya, Punjab, Tamilnadu, Uttar Pradesh and West Bengal.

Elsewhere : Nepal and Sri Lanka.

Family SYRPHIDAE

The Syrphids or flower flies or hoverflies, as the names signify, usually hover over flowers facilitating pollination. The larval habits of syrphids are extremely varied, but one large section,

the adult of which are characterized by a sharp down curving of wing vein R_{4+5}; generally feed on decaying organic materials in semi or entirely aquatic environments, such as sewage, liquid mud, and water filled privies. They may be phytophagous, carnivorous, saprophagous, scavengers and are natural enemies of aphids, scale insects, *etc*. 256 species under 62 genera of 2 subfamilies are so far known from India.

Key to the subfamilies

1. Pronotum bare (except few long hairs occasionally in *Baccha) :* abdomen in males with 5 pregenital segments ..... ***Syrphinae***

— Pronotum pilose; abdomen in males with 4 pregenital segments ..... ***Milesinae***

Subfamily SYPHINAE

Key to the tribes

1. Tergite 1 well developed and distinctly extended well beyond scutellum; scutellum at its posterior margin inconspicuously or strongly denticulate; abdomen robust and usually oval ..... **Paragini**

— Tergite 1 small and practically convexed by scutellum (excepting some *Bacchini* with petiolate abdomen) : scutellum posteriorly smooth and not denticulate; abdomen usually slender 2

2. Face and scutellum entirely black; anterior flat portion of mesopleuron with only microscopic pubescence : aedeagus undivided, strongly swollen basally and slender tube-like apically .... **Melanostomatini**

3. Face and scutellum yellow or yellowish brown; mesopleural hairing variable; aedeagus nearly always 2-segmented, with complex associated structures ..... **Syrphini**

Tribe SYRPHINI

Key to the genera

1. Mesopleuron at its anterior flat portion with long, fine, erect or suberect hairs at least posterolaterally; metasternum haired : male terminalia with broad and somewhat flat surstylus, superior lobe with a short stout tooth apically ..... ***Episyrphus*** Matsumura& Adachi

— Mesopleuron at its anterior flat portion with only microscopic pubescence or pollinose 2

2. Eyes usually very distinctly haired; wing membrane trichose at least beyond level of end of spurious vein; hind trochanter in male without any projection ..... ***Betesyrphus*** Matsumura

— Eyes bare or nearly so; wing membrane trichose anywhere : hind trochanter in males with ventral spine-like process ..... ***Ischiodon*** Sack

Genus ***Betasyrphus*** Matsumura

1917. *Betasyrphus* Matsamura, *Ent. Mag. Kyoto*, **2** : 143. Type-species : *Syrphus serarius* Wiedemann.

13. ***Betasyrphus serarius*** (Wiedemann)

1830. *Syrphus serarius Wiedemann, Aussereurop. Zweifl. Insekt.*, **2** : 128.

Material examined : 1G, Ropar, Nangal, Punjab, 6.iii.2002, Coll. P. Parui.

Diagnosis : Eye densely haired; face orange with black tinge; antenna black, base of antennal segment 3 dull orange; mesonotum shining black, scutellum dull yellow with yellow hairs basally and rest black; grayish-pollinose abdominal markings; aedeagal base with 2 long distinct tooth-like processes on each side antero-ventrally.

Distribution : Arunachal Pradesh, Assam, Bihar, Karnataka, Meghalaya, Punjab, Sikkim, Uttar Pradesh and West Bengal.

Elsewhere : Other parts of Southeast Asia; Australia; Japan, Korea and New Guinea.

Genus ***Episyrphus*** Matsumura & Adachi

1917. *Episyrphus* Matsumura & Adachi, *Ent. Mag. Kyoto*, **2** : 134. Type-species; *Muscat balteata* De Geer.

14. ***Episyrphus balteatus*** (De Geer)

1776. *Musca balteata* De Geer, *Mem. Pour. Serv. Hist. Ins.*, **6** : 116.

Material examined : 1E, Nangal, Ropar, Punjab, 6.iii.2002, Coll. P. Parui; 1G, Bella village, Una, 5.iii.2002, Coll. A.R. Lahiri; 1G, Rampur, Una, Himachal Pradesh, 4.iii.2002, Coll. P. Parui.

Diagnosis : Eye bare; face orange with orange hairs; base of antenna with a black dot above; abdomen linear, orange, tergites 3 and 4 mostly yellow with narrow sub basal and broad apical black bands; surstylus in male terminalia straight, not more than twice as long as broad; superior lobe stout, with ventro-laterally directed tooth apically; distal portion of aedeagus not expanded apically.

Distribution : Assam, Arunachal Pradesh, Himachal Pradesh, Jammu and Kashmir, Kerala, Meghalaya, Orissa, Punjab, Sikkim, Tripura and West Bengal.

Elsewhere : China, Malaya & Other parts of Oriental region; Australia, Bonin Island; Palaearctic region.

Genus ***Ischiodon*** Sack

1913. *Ischiodon* Sack, *Ent. Mitt.*, **2** : 5. Type-species : *Ischiodon trochanterica* Sack (= *Scaeva scutellaris* Fabricius).

15. ***Ischiodon scutellaris*** (Fabricius)

1805. *Scaeva scutellaris* Fabricius, *Syst.. Antliat.*, : 252.

Material examined : 1G, F.R.H., Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.

Diagnosis : Eyes bare; wing with vein R_{4+5} up curved apically and ending well before wing apex; hind femur with a sub apical black ring; surstylus in male terminalia elongate, broadened beyond base, dorsally curved and serrate, ventrally straight and smooth, aedeagal base very large and strongly sclerotized.

Distribution : Punjab and Throughout India.

Elsewhere : Many parts of Southeast Asia; Australia; Hawaii, Japan, Micronesia.

Tribe MELANOSTOMINI

Genus ***Melanostoma*** Schiner

1860. *Melanostoma* Schiner. *Wien, Ent. Mscher.*, **4** : 213. Type-species : *Musca mellina* Linnaeus.

16. ***Melanostoma orientale*** (Wicdemann)

1824. *Syrphus orientale* Wiedemann, *Analecta Ent. :* 36.

Material examined : 1G, Nangal, Ropar, Punjab, 6.iii.2002, Coll. P. Parui.

Diagnosis : Eyes bare; antennae blackish, arista microscopically pubescent; proboscis blackish; thorax and scutellum all shining aenous, with soft yellowish to greyish or brownish-grey pubescence; abdomen moderately shining black : legs orange : wings pale yellowish-grey.

Distribution : Punjab, & Throughout India.

Elsewhere : Many parts of the Oriental region; Palaearctic region.

Tribe PARAGINI

Genus ***Paragus*** Latreillc

1804. *Paragus* Latreille, *Nouv. Diet. Hist. Nat.*, **24** : 94. Type-species : *Syrphus bicolor* Fabricius.

Key to the subgenera

1. Eye with bicolourous pile, with alternating vitta of pale and dark hairs; spurious vein shorter, not extending beyond discal (r-m) cross vein ..... ***Paragus*** Latreille

— Eye with unicolourous pile; spurious vein long, extending beyond discal (r-m) cross vein ... . ***Pandasyopthalmus*** Stukenberg

Subgenus ***Paragus*** Latreille

1804. *Paragus* Latreille, *Nouv. Did. Hist. Nal.*, **24** : 94. Type-species : *Syrphus bicolor* Fabricius.

17. ***Paragus (Paragus) serratus*** (Fabricius)

1805. *Mulio serratus* Fabricius, *Syst. Antliat.*, : 186.

Material examined : 3♂, Nangal, F.R.H., Ropar dist., Punjab, 28.ix.2002, Coll. P. Parui.

Diagnosis : Eye with 3 vittae of white hairs; scutellum black with yellow margin, strongly denticulate posteriorly; abdomen yellow with brown markings, punctate, tergites 3 and 4 each with a whitish band on each side anteriorly broken in mid-line, tergite 5 with a similar but continuous band placed diagonally.

Distribution : Assam, Bihar, Goa, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.

Elsewhere : Jakarta, Jawa, East Malaysia, Nepal, Pakistan, Sri Lanka, Africa, Papuan sub regions.

Subgenus ***Pandasyopthalmus*** Stuckenberg

1954. *Pandasyopthalmus* Stuckenberg, *Revue zool. Bot. Afr.*, **49** : 100. Type-species : *Paragus longiventris* Loew.

18. ***Paragus (Pandasyopthalmus) rufiventris*** Brunetti

1913. *Paragus rufiventris* Brunetti, *Rec. Indian Mus.*, **8** : 157.

1975. *Paragus (Pandasyophthalmus) tibialis rufiventris* Brunetti : Knutson, Thomson & Vockeroth, *A Catalog of Diptera of the Oriental region*, **2** : 328.

1983. *Paragus (Pandasyophthalmus) rufiventris* Brunetti : Datta & Chakarborti, *Rec. zool. Surv. India*, **81** : 245.

Material examined : 4♂, Nangal, F.R.H., Ropar dist., Punjab, 28.ix.2002, Coll. P. Parui.

Diagnosis : Frons shining black, hind border of eye with a fringe of white hairs; face pale lemon yellow; antenna blackish brown with third segment reddish brown below at base; thorax and scutellum covered with fine black pubescence; coxae and basal half of all femora black; apical half appears lemon yellow which extends up to basal third of tibiae and the remainder brownish yellow; wing hyaline; basal half of abdomen blue black, apical half bright reddish yellow, whole dorsum covered with white hairs.

Distribution : Assam, Bihar, Punjab, Uttaranchal and Uttar Pradesh.

Elsewhere : None.

Genus ***Mesembrius*** Rondani

1857. *Mesembrius* Rondani, *Dipterol. ital*, *Prodr.*, **2** : 50. Type-species : *Helophilus peregrinus* Loew.

Key to the species

1. Mid femur in males with a tooth below near base and suddenly contracted at apex; abdominal segment 4 with an inverted, widely open V-mark ..... ***bengalensis*** (Wiedemann)

— Mid femur in males without such tooth and very gradually narrow apically; abdominal segment 4 without a V-mark ..... ***quadrivittatus*** (Wiedemann)

19. ***Mesembrius bengalensis*** (Wiedemann)

1819. *Eristalis bengalensis* Wiedemann, *Zool. Mag.*, **1** : 16.

Material examined : 2G, 2E, F.R.H., Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.

Distribution : Assam, Bihar, Gujarat, Kerala, Punjab, Tripura and West Bengal.

Elsewhere : Other parts of South-East Asia to New Guinea and Northern Australia.

20. ***Mesembrius quadrivittatus*** (Wiedemann)

1819. *Eristalis quadrivittatus* Wiedemann, *Zool. Mag.*, **1** : 17.

Material examined : 1G, 3E, Anandpur, Naina Devi Road, Punjab, 22.x.2002, Coll. P. Parui.

Distribution : Assam, Bihar, Gujarat, Karnataka, Madhya Pradesh, Orissa, Punjab, Tamil Nadu, Tripura and West Bengal.

Elsewhere : Java, Moluccas, Nepal, Sri Lanka.

Subfamily MILESINAE

Genus ***Syritta*** Lepeletier & Serville

1828. *Syritta* Lepeletier & Serville, In Latreille *et. al.*, *Encycl. Meth. (Ins.)*, **10**(2) : 808. Type-species : *Musca pipiens* Linnaeus.

Diagnosis : Face with a central keel; anterior cross-vein situated at middle of discal cell; hind femur highly increassated with short rigid spines below; second tergite projecting backwards at sides bearing a fringe of hairs.

Key to the species

1. Hind femur extremely incrassate with serrations on apical third below; abdominal spots in male on 2nd and 3rd segments definitely separated ..... *pipiens* (Linnaeus)

— Hind femur not so incrassate with serrations from base to apex; abdominal spots in male on 2nd and 3rd segments normally united ..... *orientalis* Macquart

21. ***Syritta orientalis*** Macquart

1824. *Syritta orientalis* Macquart, *Dipt. expt.*, **2**(2) : 76 (136).

Material examined : 3EE, F.R.H., Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.

Distribution : Bihar, Pondicherry, Punjab and West Bengal.

Elsewhere : Bangladesh, Jawa, Myanmar, Singapore and Sikkim.

22. ***Syritta pipiens*** (Linnaeus)

1758. *Musca pipiens* Linnaeus, *Syst. Nat. Ed.*, **10** : 594.

Material examined : 2EE, F.R.H., Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.

Distribution : Himachal Pradesh, Punjab, Uttar Pradesh and West Bengal.

Elsewhere : Nepal, Holarctic.

Family CONOPIDAE

Subfamily CONOPINAE

Diagnosis : Third antennal joint terminating in a distinct, 2-jointed, apical style; ocelli absent; members of this subfamily resembles more or less Wasp-like appearance.

Genus ***Archiconops*** Krober

1939. *Archiconops* Krober, *Ann. Mag. nat. Hist.*, (11)**4** : 381. Type-species : *Conops insularis* Krober.

23. ***Archiconops erythrocephala*** (Fabricius)

1794. *Conops erythrocephala* Fabricius, *Ent. Syst.*, **4** : 392.

Material examined : 1G, 1E, Patralwn, Gurudaspur dist., Punjab, 25.ix.2002, Coll. A.R. Lahiri.

Diagnosis : Head with silvery white reflection; antenna black; basal half of proboscis reddish-brown, rest black; scutum black except dull orange humerus; pleuron black with silvery white reflection and broad silvery-white stripe from behind humerous to middle coxa; fore femur reddish-brown or orange-brown except at tip, mid and hind femora black, or dark brown; wing blackish brown, violet tinged; abdomen violet black, last segment of males white dusted.

Distribution : Bihar, Gujarat, Maharashtra, Meghalaya, Punjab, Sikkim, Tamil Nadu and West Bengal.

Remarks : The specimen is fitting with the detailed description as in Fauna (1923) but there is a big difference in the male genitalia as figured in Fauna. This being a single specimen thus kept under the species.

Family DIOPSIDAE

The diopsids or “stalk-eyed flies” are represented by 8 species under 5 genera of subfamily Diopsinae in India. Adults are found on herbage about streams or pools, sometimes in large numbers and larvae are saprophagous or phytophagous.

Subfamily DIOPSINAE

Diagnosis : Face distinctly divided by a vertical median sulcus; eye-stalk medium or long; scutellar spines with or without a short bristle apically; alula of wing lacking; fifth vein (M_3 + Cu 1) present but sixth vein (Cu_2 + 2a) absent.

Key to the genera

1. Eye-stalk thick and short; inner orbital bristle stout ..... ***Sphyracephala*** Say
— Eye-stalk long and slender; inner orbital bristles weak ..... ***Diopsis*** Linnaeus

Genus ***Diopsis*** Linnaeus

1775. *Diopsis* Linnaeus, *Dissert. Ent. Bigas Ins. Sistens*, etc., : 1. Type-species : *Diopsis ichneumonea* Linnaeus.

24. ***Diopsis indica*** Westwood

1837. *Diopsis indica* Westwood, *Trans. Linn. Soc. Lond. (Zool)*, **17** : 299.

Material examined : 1G, Thum dam site Gurudaspur, Punjab, 1.iii.2002, Coll. P. Parui.

Diagnosis : Face glossy yellowish red, with strong facial teeth; legs yellowish red; wings mainly hyaline, with a round dark spot at tip on vein 3(R_{4+5}) without touching vein 4 (M_{1+2}).

Distribution : Arunachal Pradesh, Assam, Gujarat, Meghalaya, Punjab, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh to South China, South Java.

Genus ***Sphyracephala*** Say

1828. *Sphyracephala* Say, *Am. Ent.*, **3** : 52. Type-species : *Diopsis brevicornis* Say.

25. ***Sphyracephala hearseiana*** (Westwood)

1845. *Diopsis hearseiana* Westwood, *J. Proc. ent. Soc. Lond.*, **1** : 1844 : 99.

Material examined : 1G, Barmla, Ropar, Punjab, 27.ix.2002, Coll. A.R. Lahiri.

Diagnosis : The short thick eye-stalks easily separate this species (and genus) from all other Oriental Diopsidae and its clear wing separates it from congeneric species *cothurnata* Bigot.

Distribution : Gujarat and Punjab.

Elsewhere : Bangladesh.

Family OTITIDAE

The family is known in India only by 2 species under the genus *Physiphora* under the subfamily Ulidinae. Adults are commonly found on vegetation and larvae are believed to be saprophagous.

Subfamily ULIDINAE

Diagnosis : Aedeagus bare, without bristles, hairs or denticles, tip sometimes specialized.

Genus ***Physiphora*** Fallén

1810. *Physiphora* Fallen, *Sp. ent. nov. Dip.*, : 11. Type-species : *Chrysomya splendida* Fallén.

Diagnosis : Head at most a little longer than high; medifrons bare, in upper part with four swellings; antennal segment 3 rounded apically; humeral bristle usually well developed; wing with basal cell 2 closed by straight or zigzag vein.

26. ***Physiphora aenea*** (Fabricius)

1794. *Musca aenea* Fabricius, *Ent. Syst.*, **4** : 335.

Material examined : 6GG, 4EE, Una, Rampur riverside, Himachal Pradesh, 4.ii.2002, Coll. P. Parui.

Diagnosis : Epistome, proboscis and palpi black; frontal stripe green or blue; wings with petiolate posterior cell 1; abdomen unicolorous, green, hairs on anterior corners yellowish.

Distribution : Assam, Chandigarh, Himachal Pradesh, Orissa, Punjab and West Bengal.

Elsewhere : Widespread from Seychelles to Samoa; Hawaii to Australia; North and South Americas.

Family SEPSIDAE

About 200 species of these small flies with a somewhat ant-like build are known from the world. The larvae are saprophagous and found in dung. The adults are often very abundant on the larval food and on flowers. In India 17 species under 8 genera of 2 subfamilies are so far known.

Subfamily SEPSINAE

Diagnosis : Thorax and abdomen usually shining, at least on parts of pleura; mouth opening not large; microsetae present, and often macrochaetae on abdomen; mid femur not bent on middle.

Key to the genera

1. First and second basal cells united; fronto-orbital bristles present .....***Australosepsis*** Malloch

— First and second basal cells separate; fronto-orbital bristles may be present or absent .... ***Sepsis*** Fallén

Genus ***Sepsis*** Fallén

1810. *Sepsis* Fallén, *Sp. Ent. Nov. Dipt.*, : 17. Type-species : *Sepsis cynipsea* Linnaeus.

27. ***Sepsis rufa*** (Macquart)

1850. *Sepsis rufa* Macquart, *Dipt. Exot. Supp.*, **4** : 269.

Material examined : 13GG, 9EE, Dunera, Gurudaspur, Punjab, 15.ix.2002, Coll. P. Parui.

Diagnosis : The males are easily recognised by their fore femora. Body dark, second abdominal segment often with two slightly yellowish marks, dark red brown frons and posterior femora often only streaked above with black.

Distribution : Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Meghalaya, Orissa, Punjab, Sikkim, Uttar Pradesh and West Bengal.

Elsewhere : Myanmar, Nepal.

Genus ***Australosepsis*** Malloch

1925. *Australosepsis* Malloch, *Proc. Linn. Soc. N. SW.*, **50** : 314. Type-species : *Australosepsis fulvescens* Malloch.

28. ***Australosepsis frontalis*** (Walker)

1860. *Sepsis frontalis* Walker, *J. Proc. Linn. Soc. Lond. Zool.*, **4** : 163.

Material examined : 1G, Santoshgarh, Punjab, 21.ix.2002, Coll. A.R. Lahiri.

Diagnosis : Head, thorax and scutellum brownish yellow, the later with single pair of bristles at its border; legs wholly yellow, front femur of male with a row of strong bristles covering 4th of its length; wing without any infuscation at this end of R3+4 which distinguishes the only other known Oriental species *niveipennis* (Becker).

Distribution : Andhra Pradesh, Gujarat, Kerala, Maharashtra and Punjab.

Elsewhere : Borneo, Sulawasi, Lesser Sunda Islands, Malaysia, New Caledonia, Philippines, Singapore, Sri Lanka, Taiwan.

Family MUSCIDAE

Muscids are one of the most diversified and economically important groups of the Calyptrate Diptera belonging to the suborder Cyclorrhapha. Adults may be predacious, saprophagous, pollenophagous or haematophagous. Females are typically oviparous, a few are larviparous also. Larvae have varied habits being saprophagous, parasitic and phytophagous.

Key to the subfamilies

1. Arista long plumose; proboscis licking type, rather short and stout; labella well developed; usually 1 + 2 Sternopleural bristles ..... MUSCINAE

— Arista pectinate, proboscis elongate, strongly sclerotized, adopted for piercing, tapering from a broad base to a slender apex; labella atrophied; never more than 1 + 1 sternopleural bristles ..... STOMOXYINAE

Subfamily MUSCINAE

Genus ***Orthellia*** Robineau-Desvoidy

1863. *Orthellia* Robineau-Desvoidy, *Hist. nat. Dipt. env. Paris,* **2** : 837. Type-species : *Orthellia cornicina* (Fabricius).

Diagnosis : Metallic blue or green flies; supresquamal ridge with black setulose hairs on posterior part; prostigmal seta distinct, mid tibia with a strong pv seta beyond middle; bend of vein m angular or gently curved.

29. ***Orthellia timorensis*** (Robineau-Desvoidy)

1830. *Lucilia timorensis* Robineau-Desvoidy, *Mem. pres. div. Sav. Acad. Sci. Inst. Fr.*, **2** : 460.

Material examined : 2G, Patralwn, Gurudaspur dist., Punjab, 25.ix.2002, Coll. P. Parui.

Diagnosis : This species is abundantly attracted to bait of cow dung exposed in suitable forest areas. Both sexes feed on the dung, and females oviposit readily in the pads. Human faeces are particularly attractive to this species. All three larval instars are saprophagous. When mature the larvae migrate from the dung and pupate in the soil around.

Distribution : Andhra Pradesh, Assam, Bihar, Kerala, Punjab, Sikkim, Tamil Nadu. Tripura, Uttar Pradesh and West Bengal.

Elsewhere : Widespread in Oriental region; Japan; Papuan sub region.

Subfamily STOMOXYINAE

Genus ***Stomoxys*** Geoffroy

1762. *Stomoxys* Geoffroy, *Hist. abreg. Ins. Paris*, **2** : 499. 538. Type-species; ***Stomoxys*** *calcitrans* (Linnaeus).

30. ***Stomoxys calcitrans*** (Linnaeus)

1758. *Conops calcitrans* Linnaeus, *Syst. Nat. Ed.*, **10**, 1 : 604.

Material examined : 1E, Bella village, Una dist., Himachal Pradesh, 5.iii.2002, Coll. A.R. Lahiri.

Diagnosis : Fuscous black with whitish-grey or cinereous-grey pollinocity and some brown dust on the dark thoracic vittae and forming spots on abdomen; eyes in male separated by a quarter head-width or somewhat more, frons very slightly narrowed from vertex to middle, moderately dilated from there to lunula, interfrontalia parallel-sided; in female frons well over a third head-width at vertex; antennae fuscous-brown, apex of second and base of third segment dull reddish-orange; palpi yellowish-orange, only slightly longer than third antennal segment, not reaching fore margin of mouth; thorax with four fuscous vittae, which are somewhat brown-dusted; abdomen with a moderately broad less densely dusted and darker median vitta and similar fore and hind

margins; wings with the setulae on r4+5 not nearly reaching r-m, m strongly up curved and distinctly sinuous near apex; legs fuscous with pale testaceous knees; base of hind femur with only one long hair, which seldom reaches length of femoral diameter, often with 2–3 shorter hairs following upon the long hair, hairs of the av row somewhat stronger and more erect.

Distribution : Andhra Pradesh, Assam, Bihar, Goa, Himachal Pradesh, Kerala, Maharashtra, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.

Elsewhere : Cosmopolitan.

Family CALLIPHORIDAE

The Calliphorids or blowflies or blue bottle flies are commonly found on vegetation or flowers, meat shops or fish markets, etc. The larvae arc either scavengers or parasites on other insects, earthworms, snails or other animals. Some are well known for causing myiasis in man and animals.

Subfamily RHINIINAE

Diagnosis : Epistome strongly projected; antennal arista varies from microscopically pubescent to strongly biplumose; prostigmal bristles absent, the small rounded prostigamal bristle absent, the small rounded protuberance below base of wing either bare or without distinct hairs, thoracic squama bare dorsally; wing with subcostal sclerite with fine pubescence.

Key to the genera

1. Body slender and equilateral; hind tibia without a conspicuous row of anterodorsal setae but with 2–3 setae as long as or longer than tibial diameter; abdomen mostly testaceous .... ***Idiella*** Brauer & Bergenstamm.

— Body rather stout, with ovate abdomen; hind tibia with a conspicuous row of subequal anterodorsal setae longer than normal hairs, sometimes 2–3 rather strong anterodorsal setae developed among them; abdomen usually dark coloured ..... ***Stomorhina*** Rondani

Genus ***Idiella*** Braeuer and Bergenstamm

1889. *Idiella* Braeuer and Bergenstamm, *Denkschr. Akad. Wiss. Wien.*, **56** : 154. Type-species : *Idia mandarina* Wiedemann.

31. ***Idiella mandarina*** (Wiedemann)

1830. *Idia mandarina* Wiedemann, *Aussereurop. zwifl. Insekt.*, **2** : 350.

Material examined : 1G, Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.

Diagnosis : Male frons usually broader than width of ocellar triangle : female frons one-fifth of head width : antennal segment 2 at least reddish; occipital dialation, mesopleuron and sternopleura

without distinct piliferous spots; pleura with golden hairs; mid tibia in males with 2 posterior setae and a tuft of hairs distally; wing with basicolor brown.

Distribution : Assam, Bihar, Gujarat, Haryana, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh, China, Indonesia, Malaysia. Myanmar, Sri Lanka, Taiwan and Thailand.

Genus ***Stomorhina*** Rondani

1861. *Stomorhina* Rondani, *Dipt. Ital. Prodr.*, **4** : 9. Type-species : *Musca lunata* Fabricius.

32. ***Stomorhina discolor*** (Fabricius)

1794. *Musca discolor* Fabricius, *Ent. Syst.*, **4** : 320.

Material examined : 1G, Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.

Diagnosis : Antennae and palpus brown; wing with cell R_5 narrowly open; abdomen yellowish, with black bands posteriorly on terga 1 & 2 and with a median longitudinal stripe.

Distribution : Arunachal Pradesh, Assam, Bihar, Kerala, Manipur, Meghalaya, Punjab. Uttar Pradesh and West Bengal.

Elsewhere : Other Parts of Oriental region, Moluccas.

Family SARCOPHAGIDAE

The members of this family are commonly known as flesh flies. Adults are generally found on vegetation, flowers, excrement or decaying plant and animal material. Larvae are saprophagous or coprophagous and live in decaying plant or animal matter or are parasites of insects and others. In India 65 species under 26 genera of 3 subfamilies are reported so far.

Subfamily SARCOPHAGINAE

Diagnosis : Arista pubescent to plumose on basal two thirds; notopleurals invariably 3 or 4; stem vein of wing setulose on posterior upper side of its basal section.

Genus ***Parasarcophaga*** Johonston & Tiegs

1921. *Parasarcophaga* Johonston & Tiegs, *Proc. R. Soc. Qd.*, **33** : 86, Type-species : *Sarcophaga omega* Johonston & Tiegs.

Key to the subgenera

Ventralia pedunculate ..... ***Parasarcophaga*** Johonston & Tiegs

Ventralia not pedunculate ..... ***Liosarcophaga*** Enderlein

Subgenus ***Liosarcophaga*** Enderlein

1928. *Liosarcophaga* Enderlein, *Arch. Klass. Phyl. Ent.*, **1**(1) : 18. Type-species : *Cynomyia madirensis* Schiner.

33. ***Parasarcophaga (Liosarcophaga) dux*** (Thomson)

1868. *Sarcophaga dux* Thomson, *K. Svenska Fregatten Eugenies Resa. Dipt.*, **2** : 534.

Material examined : 1G, Nangal, Punjab., 6.ii.2002, ColI. A.R. Lahiri.

Diagnosis : Lateral verticals wanting; propleura bare, single pre-sutural acrostichal, posterior dorsocentral 5 the anterior 3 weak; mid femur with comb and fringe at base, hind tibia double fringed; apex of paraphallus pointed with a subapical process having bifurcated apex.

Distribution : Punjab and quite common in all the states of India.

Elsewhere : Bangladesh, China, Hainan Islands, East Malaysia, Java, Kalimantan, Ryukyu Islands, Sri Lanka. Taiwan; Australia; Hawaii, Japan, Korea, New Guinea.

34. ***Parasarcophaga (Parasarcophaga) orchidea*** (Boettcher)

1913. *Sarcophaga orchidea* Boettcher, *Annls. Hist.-nat. Mus. natn. Hung.*, **11** : 375.

Material examined : 1G, Chandigarh, Kotari Bangla, H.P., 20.x.2000, Coll. M.L. Thakur.

Diagnosis : Frons and face silver white, lateral verticals wanting; acrostichal bristles 1 : 1; mid femur with comb and sparse basal fringe; costal segment iii longer than v; apical process of paraphallus well developed.

Distribution : Common in all the states of India including Himachal Pradesh and Punjab.

Elsewhere : Andalas, Bangladesh, China, East Malaysia, Hainan Island, Jawa, Kalimantan Myanmar, Nepal, Philippines, Ryukyu Islands, Sri Lanka, Taiwan, Thailand; Afghanistan, Korea, Japan; Widespread in the Pacific Islands to new Guinea and Australia.

SUMMARY

Altogether 34 species belonging to 29 genera under 13 families, so far reported from the parts of Punjab and Himachal Shiwalik hills are enumerated. Keys to recorded families, subfamilies, genera, subgenera and species are provided.

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