DISTRIBUTIONAL SCENARIO OF HOVER FLIES (DIPTERA: SYRPHIDAE) FROM THE STATE OF WEST BENGAL

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ABSTRACT: This study altogether includes 96 species of hover flies under 40 genera of 3 subfamilies. Our study further includes 4 species of hoverflies that are Chrysotoxum quadrifasciatum Brunetti, 1923; Eristalinus (Eristalinus) tabanoides (Jaennicke, 1867); Lycastrisalbipes Walker, 1857 and Eumerus aurifrons (Wiedemann, 1824) which are reported for the first time from the state of West Bengal. Their taxonomic keys and detailed diagnostic accounts, as well as the distributional scenario, have been discussed here with latest updation of nomenclature pattern.

KEY WORDS: Taxonomy, Diptera, Syrphidae, hover flies, new record, distribution, West Bengal

Hover flies are one of the most beneficial groups of flies which are categorized under brachyceran suborder of order Diptera and family Syrphidae (Brunetti, 1907). Syrphidae are always better documented for being a competent pollinator (Brunetti, 1923).

Syrphids can be distinguished by the presence of a unique false vein or Vena Spuria in between 3rd and 4th vein of their wing (Bugg, 2008). Apart from this, they can be recognized by the presence of body shape, colour pattern and the way of moving (Ghorpade, 1994). Moreover, hover flies form the largest and commonest group in mimics in the Palaearctic (Van Steenis et al., 2012) with up to 25% of species involved in mimicking innumerable diverse models as a part of their defence mechanism (Reuter, 2013).

Another particular attribute of hover flies is the great diversity of form, feeding mode and place of development in their larvae (Bhatia et al., 1933). Hover flies also acts as a biological monitor (De Silva, 1961) for environmental change. Syrphids are the second most important recognized pollinators and help in cross pollination (Mengual, 2012) of several plants, along with large potency in biological control of aphid pests to prevent economic hazards (Parui et al., 2002). Even then they are being properly harnessed either for pollination services or for bio control services, For all these reasons of scientific interests, environmental services, and economic welfare, hover flies are worthy of our attention.

Around 6000 hoverfly species in 180 genera are known globally (Pape & Thompson, 2017). With 355 species among them are currently described from India (Sengupta et al., 2016). Among the six zoogeographical regions, the north temperate Palaearctic (at generic level) & Neotropics (at species level) has shown the maximum diversity in this faunal distribution whereas Afro Tropical & Australian region is low in diversity in term of both genera and species level.

Because of such a wide distribution, the distributional scenario of family Syrphidae always needs an updation to track its current position in diversity hierarchy. In order to investigate the distributional account as well as to find out
the appearance of new discoveries from this family, we have carried out our survey in different localities of West Bengal. It has been chosen as the study area because of its vastness. Besides this, West Bengal being first in agricultural crop production in our country has always played a pivotal role in crop cultivation. Which is known to produce approximately 23.4 percent of total crop production of the country (De Silva, 1961). Still, there are no updated compiled records on the availability of this crop friendly flies from this state (Chaudhuri & Chattopadhyay, 1997).

The current study includes an updated distributional account of hoverflies from the state of West Bengal along with its current nomenclature, generic sub generic pattern (Pape & Thompson, 2016). Currently, 70 species under 34 genera are documented from West Bengal (Pape & Thompson, 2017) including our study as well as literature sources. This updated account includes four new records from this state also, among which several species are endemic to India (Sengupta et al., 2016).

In West Bengal Cultivation of aphidophagous hoverflies as natural bio controller as well as pollinators on the commercial basis is being neglected for long (Knutson et al., 1975). So it is important to properly investigate, harbour and conserve this group of pollinators especially the endemic ones (Thompson, 1969).

MATERIALS AND METHODS

a. Study area: Different Parts of West Bengal consist of different geographical topology, riverine plain land in the southern area with its northern fringes, the foothills of Himalaya and southern fringes of Bay of Bengal. Due to its typical topographical location, it experiences a tropical kind of climate. The geographical location of West Bengal is 23 degree North latitude and 88 degree East longitude. The wide temperature gradient, substantive vegetation cover, diverse flora, livestock, and innumerable ecological niches make the habitats diversified.

b. Sampling method: A 3 years long survey was conducted in different districts and different bio geographic zone of West Bengal from March, 2014 to March 2016. Adult syrphid fauna was collected from the field during day time by using insect sweep nets, using Malaise trap, Pan trap following the methods of Weems, 1953 later modified by Thompson, 2008. The collected samples are narcotized by using ethyl acetate and stored for further study in special drying insect envelopes in the field. The specimens were later carried back to the laboratory, mounted on insect pins and stored in insect cabinets for further identification procedure.

c. Identification of the collected specimen: The present list has been identified, updated and compiled, following the classification scheme from Oriental catalogue and Syrphidae life desk, Systema Dipterorum, Catalog of Life, incorporating the data of the Fauna of British India (1923), the State Fauna Series of Zoological Survey of India (2006), Zoological Record (2013) and currently available literature, keeping in mind the recent nomenclatural changes in the Systema Dipterorum (2017), and Catalogue of Life (2017).

d. Technical details: The photo of habitus were taken by using Leica Microscope M205A, with the 0.32x macro lens. The 3D Map was made using DIVA GIS Software version 7.5.0. The graphs were prepared using Microsoft Excel 2016.

e. Compilation method: Factually our study embraces all of the collection of hoverflies that have been deposited in the NZSI collection from last 100 years. This comprises both the deposited materials as well as previous survey materials, we have also incorporated the literature sources here to create a comprehensive
list of all hoverflies species existing from the State till date. The collection was
done all over the state especially in those areas where no detail status survey was
done previously for the family of Syrphidae.

**RESULTS**

96 species of hover flies under 40 genera over 3 subfamilies have been
reported here. A detailed systematic account of the newly reported species from
the state was described (Mcalpine, 1987) according to current systematics and
nomenclature pattern. (Pape & Thompson, 2017) along with their distribution
pattern.

**Systematic list of taxa (new records from the state is marked with
double asterisk)**

Order **DIPTERA**(Linnaeus, 1758)
Suborder **BRACHYCERA** Macquart, 1834
Clade **ASCHIZA** Becher, 1882
Superfamily **SYRPHOIDEA** Latreille, 1802
Family **SYRPHIDAE** Latreille, 1802

<table>
<thead>
<tr>
<th>Subfamily Syrphinae</th>
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<tr>
<td>Tribe Syrphini</td>
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<tr>
<td>Genus <em>Allograpta</em> Osten Sacken, 1875</td>
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<tr>
<td>Subgenus <em>Allograpta</em> Osten Sacken, 1875</td>
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<tr>
<td>1. <em>Allograpta javana</em> (Wiedemann, 1824)</td>
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Genus *Asarkina* Macquart, 1842
Subgenus *Asarkina* Macquart, 1842
2. *Asarkina ericetorum* (Fabricius, 1805)

Genus *Betasyrphus* Matsumura, 1917
3. *Betasyrphus serarius* (Wiedemann, 1830)

Genus *Dasysyrphus* Enderlein, 1938
4. *Dasysyrphus orsua* (Walker, 1852)

Genus *Dideopsis* Matsumura, 1917
5. *Dideopsis aegrota* (Fabricius, 1805)

Genus *Eupeodes* Osten Sacken, 1877
Subgenus *Macrocyphus* Matsumura, 1917
6. *Eupeodes confrater* (Wiedemann, 1830)
Subgenus *Metasyrphus* Matsumura, 1917
7. *Eupeodes corollae* (Fabricius, 1794)

Genus *Epistrophe* Walker, 1852
Subgenus *Epistrophe* Walker, 1852
9. *Epistrophe griseocinctus* (Brunetti, 1923)
Subgenus *Epistrophella* Dusek & Laska, 1967
10. *Epistrophe shibakawae* (Matsumura, 1917)

Genus *Episyrphus* Matsumura & Adachi, 1917
Subgenus *Episyrphus* Matsumura & Adachi, 1917
11. *Episyrphus balteatus* (De Geer, 1776)
Genus *Ischiodon* Sack, 1913
12. *Ischiodon scutellaris* (Fabricius, 1805)

Genus *Meliscaeva* Frey, 1946
16. *Meliscaeva cinctella* (Zetterstedt, 1843)
17. *Meliscaeva magnifica* Ghorpade, 1994

Genus *Sphaerophoria* Lepeletier & Serville, 1828
Subgenus *Sphaerophoria* Lepeletier & Serville, 1828
18. *Sphaerophoria bengalensis* Macquart, 1842
Subgenus *Knutsonia* Barkalov, 2012
Subgenus *Sphaerophoria* Wiedemann, 1830
20. *Sphaerophoria indiana* Bigot, 1884

Genus *Syrphus* Fabricius, 1775
Subgenus *Syrphus* Fabricius, 1775
21. *Syrphus fulvifacies* Brunetti, 1913

Genus *Allobaccha* Curran, 1928
Subgenus *Allobaccha* Curran, 1928
22. *Allobaccha elegans* (Brunetti, 1915)
23. *Allobaccha triangulifera* (Austen, 1893)

Genus *Chrysotoxum* Meigen, 1803
24. *Chrysotoxum quadrifasciatum* Brunetti, 1923**
25. *Chrysotoxum violaceum* Brunetti, 1923

Tribe Bacchini
Genus *Baccha* Fabricius, 1805
26. *Baccha maculata* Walker, 1852

Genus *Melanostoma* Schiner, 1860
27. *Melanostoma orientale* (Wiedemann, 1824)

Tribe Paragini
Genus *Paragus* Latreille, 1804
Subgenus *Paragus* Latreille, 1804
28. *Paragus serratus* (Fabricius, 1805)
Subgenus *Pandasyopthalmus* Stuckenberg, 1954
30. *Paragus politus* Wiedemann, 1830

Subfamily Microdontinae
Tribe Microdontini
Genus *Microdon* Meigen, 1803
Subgenus *Microdon* Meigen, 1803
31. *Microdon metallicus* de Meijere, 1904
32. *Microdon ruficaudus* Brunetti, 1907
33. *Microdon stilboides* Walker, 1849

Subgenus *Pseudomicrodon* Hull, 1937
34. *Microdon auricinctus* Brunetti, 1908

Tribe Spheginobacchini
Genus *Spheginobaccha* Meijere, 1908
35. *Spheginobaccha macropoda* (Bigot, 1884)

Subfamily Eristalinae
Tribe Brachyopini
Genus *Sphegina* Meigen, 1822
Subgenus *Sphegina* Meigen, 1822
36. *Sphegina asciiformis* Brunetti, 1915
Subgenus *Asiosphegina* Stackelberg, 1974
37. *Sphegina bispinosa* Brunetti, 1915
38. *Sphegina javana* de Meijere, 1914

Tribe Rhingiini
Genus *Cheilosia* Meigen, 1822

Genus *Rhingia* Scopoli, 1763
Subgenus *Rhingia* Scopoli, 1763
40. *Rhingia angusticincta* Brunetti, 1908
41. *Rhingia binotata* Brunetti, 1908
42. *Rhingia cincta* de Meijere, 1904
43. *Rhingia laticincta* Brunetti, 1907

Tribe Volucellini
Genus *Graptomyza* Wiedemann, 1820
44. *Graptomyza nigripes* Brunetti, 1913
45. *Graptomyza tintoxvittata* Brunetti, 1915

Genus *Volucella* Geoffroy, 1762
46. *Volucella basalis* Brunetti, 1907
47. *Volucella ursine* de Meijere, 1904

Tribe Ceriodini
Genus *Ceriana* Rafinesque, 1815
48. *Ceriana ornatifrons* (Brunetti, 1915)

Genus *Monoceromyia* Shannon, 1922
49. *Monoceromyia trinotata* (de Meijere, 1904)

Genus *Sphiximorpha* Rondani, 1850
50. *Sphiximorpha triangulifera* (Brunetti, 1913)

Tribe Eristalini
Genus *Eristalinus* Rondani, 1845
Subgenus *Eristalinus* Rondani, 1845
51. *Eristalinus arvorum* (Fabricius, 1787)
52. *Eristalinus megacephalus* (Rossi, 1794)
53. *Eristalinus obliquus* (Wiedemann, 1824)
54. *Eristalinus polychromata* (Brunetti, 1923)
55. *Eristalinus quinquestriatus* (Fabricius, 1794)
56. *Eristalinus tabanoides* (Jaennicke, 1867)**
Subgenus *Eristalodes* Mik, 1897
57. *Eristalinus paria* (Bigot, 1880)
58. *Eristalinus taeniops* (Wiedemann, 1818)
Subgenus *Merodonoides* Curran, 1931
59. *Eristalinus multifarius* (Walker, 1852)

Genus *Eristalis* Latreille, 1804
Subgenus *Eoseristalis* Kanervo, 1938
60. *Eristalis arbustorum* (Linnaeus, 1758)
61. *Eristalis cerealis* Fabricius, 1805
62. *Eristalis himalayensis* Brunetti, 1908
Subgenus *Eristalis* Latreille, 1804
63. *Eristalis tenax* (Linnaeus, 1758)

Genus *Kertesziomyia* Shiraki, 1930
Subgenus *Kertesziomyia* Shiraki, 1930
64. *Kertesziomyia cyanea* (Brunetti, 1913)
Subgenus *Pseuderistalis* Shiraki, 1930
65. *Kertesziomyia nigra* (Wiedemann, 1824)

Genus *Phytomia* Guerin-Meneville, 1833
Subgenus *Phytomia* Guerin-Meneville, 1833
66. *Phytomia argyrocephala* (Macquart, 1842)
67. *Phytomia errans* (Fabricius, 1787)
68. *Phytomia zonata* (Fabricius, 1787)
Subgenus *Dolichomerus* Macquart, 1850
69. *Phytomia crassa* (Fabricius, 1787)

Genus *Mallota* Meigen, 1822
Subgenus *Mallota* Meigen, 1822
70. *Mallota curvigaster* (Macquart, 1842)
71. *Mallota orientalis* (Wiedemann, 1824)
72. *Mallota rufipes* Brunetti, 1913
73. *Mallota varicolor* (Walker, 1856)

Genus *Mesembrius* Rondani, 1857
Subgenus *Mesembrius* Rondani, 1857
74. *Mesembrius bengalensis* (Wiedemann, 1819)
75. *Mesembrius quadrituberculatus* (Brunetti, 1907)
76. *Mesembrius vestitus* (Wiedemann, 1821)

Genus *Pararctophila* Herve-Bazin, 1914
78. *Pararctophila bengalensis* Kohli, Kapoor & Gupta, 1988

Tribe Merodontini
Genus *Eumerus* Meigen, 1822
79. *Eumerus aeneithorax* Brunetti, 1915
80. *Eumerus aurifrons* (Wiedemann, 1824)**
81. *Eumerus halictoides* Brunetti, 1915
82. *Eumerus pulcherrimus* Brunetti, 1915
83. *Eumerus rufoscutellatus* Brunetti, 1913

Tribe Milesiini
Genus *Lycastris* Walker, 1857
84. *Lycastris albipes* Walker, 1857**
85. *Lycastris austeni* Brunetti, 1923
86. *Lycastris flavohirta* Brunetti, 1907

Genus *Milesia* Latreille, 1804
87. *Milesia balteata* Kertesz, 1901
89. *Milesia ferruginosa* Brunetti, 1913
90. *Milesia illustris* Hippa, 1990
91. *Milesia semifulvate* Meijere, 1904
92. *Milesia variegata* Brunetti, 1908
Genus *Syritta* Lepeletier & Serville, 1828
93. *Syritta indica* (Wiedemann, 1824)
94. *Syritta orientalis* Macquart, 1842

Genus *Chalcosyrphus* Curran, 1925
Subgenus *Syrittoxylota* Hippa, 1978
95. *Chalcosyrphus annulatus* (Brunetti, 1913)

Genus *Xylota* Meigen, 1822
Subgenus *Brachypalpoides* Hippa, 1978
96. *Xylota cupreiventris* Brunetti, 1923

**Diagnostic account of four new records from the family Syrphidae**

Subfamily Syrphinae

**Tribe Syrphini**

Genus *Chrysotoxum* Meigen, 1803
Type species: *Musca bicincta* Linnaeus

Diagnosis: Antenna elongate, sometimes longer than head; first flagellomere at least three times as long as wide; scape and pedicel often longer than wide. Abdomen strongly convex dorsally, strongly marinated, usually with poster lateral angles of tergites projectng.

*Chrysotoxum quadrifasciatum* Brunetti, 1923 (Fig. 1A)
= *Chrysotoxum rotundatum* Herve-Bazin, 1923

Type locality: Assam, Khasi hills, India.
Material examined: 1♀, Upumfatak, Darjeeling district, 2256 m, 27°00′10.9″ N, 88°13′14.1″ E, 08.vi.14, coll: D Banerjee.

Diagnosis: **Head:** Frons, vertex, and antennae shining black, a pair of large, oval, grey dust spots contiguous with eye margins, face brownish orange in colour with wide black median stripes. Proboscis dark brown. **Thorax:** Dorsal shining black with yellowish scutellum, pubescence of thorax brownish yellow in colour, venter black. **Abdomen:** Blackish, 2nd and 3rd each with a pair of transverse linear orange spots forming a slight arch just behind abdominal margin. **Leg:** Upto tip of tarsi brownish orange in color, femora more or less blackish. **Wing:** Yellowish-grey with 2nd vein having brownish or yellow suffusions.


Subfamily Eristalinae

**Tribe Eristalini**

Genus *Eristalinus* Rondani, 1845
Type species: *Musca sepulchralis* Linnaeus

Diagnosis: Head as broad as the thorax, thorax with yellowish brown scutellum, Abdomen yellow to orange in coloration. Legs simple orange to black in colouration. 3rd vein distinctly looped downward, marginal cell closed.

Subgenus *Eristalinus* Rondani, 1845

*Eristalinus tabanoides* (Jaennicke, 1867) (Fig. 1B)
Type locality: Eritrea.
Material examined: 4♀3♂ Sukhiapokhari, Darjeeling district, 1928 m, 26°59′54.9″ N, 88°10′01.9″ E, 11.vi.14, coll: A.Naskar.
Diagnosis: **Head:** Not produced below eyes, later bare and spotted throughout. Frons and face dusted with pale yellowish grey concolorous pubescence. **Thorax:** Wholly ash grey, the presence of four shining black stripes on dorsum, scutellum dull orange in colour with brownish yellow pubescence. **Abdomen:** Mainly blackish, 1st segment whitish while 2nd more or less yellowish, abdominal pubescence ground in colour. **Leg:** Blackish with whitisht pubescence. **Wing:** Mainly colorless, stigma with a brownish black dot at each end, halters orange in color.
Distribution: India (West Bengal, Delhi).
Elsewhere: Eritrea, Djibouti, Tunisia, Egypt.

**Tribe Milesiini**

**Genus Lycastris** Walker, 1857
Type Species: *Lycastris albipes* Walker

Diagnosis: Head flattened in front, slightly, wider than thorax. Eyes bare, separated on the vertex. Thorax sub quadrate, semi-circular scutellum; both densely pubescent. Legs rather long and strong, simple, moderately pubescent. Wings with a distinguished venation.

**Lycastris albipes** Walker, 1857 (Fig. 1C)
= *Xiphopheromyia glossata* Bigot, 1892

Type locality: Hindostan.
Material examined: 1♀, Rock Island, Darjeeling district, 511 m, 27°00′29.8″ N, 88°48′07.0″ E, 17.v.2015, coll: J. Sengupta.
Diagnosis: **Head:** Eyes bare, contiguous for a very short space. **Thorax:** From yellowish grey to black in colour, scutellum covered with dense and rather long bright yellow pubescence. **Abdomen:** Blackish in colour with aeneous, cupreous or deep blue tinge on its dorsal surface. Anterior margin of the 2nd segment in the form of elongated V shaped spots. Venter blackish with pale yellow or whitish pubescence. **Leg:** Anterior portion yellow, hind femora wholly black, legs covered with bright yellow to whitish pubescence. **Wing:** Grey in colour, a little brownish suffusion along the cross vein in the middle of the wing. Halters slightly yellowish grey in color.
Distribution: India (West Bengal, Himachal Pradesh, Uttarakhand).
Elsewhere: Oriental region.

**Tribe Merodontini**

**Genus Eumerus** Meigen, 1822
Type Species: *Syrphus tricolor* Fabricius

Diagnosis: M1 vein of wing strongly biangulate, with an external spur; the apical portion of M1 forming on its outer side an acute angle with R4+5. Hind femur greatly enlarged, with anteroventral and poster ventral row of spines near apex. Eye haired.
**Eumerus aurifrons** (Wiedemann, 1824)(Fig. 1D) 

1824, *Eumerus aurifrons* Wiedemann, Analecta. ent., 1: 32

Type locality: Ind Orient region.

Material examined: 1♀, Chachanpur, Bankura district, 110 m, 23°17' 54.9" N, 86° 53' 55.3" E, 28.ii.16, Coll: J. Sengupta.

Diagnosis: **Head:** Eyes slightly but distinctly separated, vertical triangle elongated, ocellar space covered with dark brown pubescence. **Thorax:** Both thorax and scutellum shinningly aeneous, the presence of 2 widely separated narrow and grey longitudinal stripes from anterior margin to well beyond the suture. **Abdomen:** Shining blue black in colour, 2nd segment with large yellow spots while 3rd and 4th each with a pair of narrow slightly curved greyish spots. Venter mainly yellowish in color. **Leg:** Mainly black, anterior femora rather broadly and hind femora narrowly orange. Pubescence of legs mainly yellowish in colour. **Wing:** Clear with normal syrphid venation, halters yellowish to orange in colour.

Distribution: India: West Bengal.
Elsewhere: Hawaii, Indonesia, Philippines.

**DISCUSSION**

Altogether 96 species of hoverflies under 40 genera and 3 subfamilies have been reported (including both survey data and literature sources) from different study sites across the different bio geographic zone of West Bengal during our 3 year-long survey period (March 2014 to March 2016). Among them 4 species of hover flies namely *Chrysotoxum quadrifasciatum* Brunetti, 1923; *Eristalinus (Eristalinus) tabanoides* (Jaennicke, 1867); *Lycastris albipes* Walker, 1857 and *Eumerus aurifrons* (Wiedemann, 1824) under 4 genera and 2 sub families have been reported from the first time from the state of West Bengal. Among all this species 1 species *Chalcosyrphus (Syrittoxylota) annulatus* (Brunetti, 1913) shows endemism to the mountain region of West Bengal. The GIS distribution map of West Bengal has shown the collection sites of the newly reported species from this state. Few species are rarely distributed along the state while most of the species have shown more or less wide distribution pattern across the state. Among different geographic zones of West Bengal, the Rarh plain region has shown the least species richness in terms of a number of species availability from that region. While Mountain region has shown the highest species richness. Apart from this, this region has shown a remarkable higher percentile of type species location of the family Syrphidae. Among the species, one species namely *Episyrphus (Episyrphus) balteatus* (De Geer, 1776) is most widely spread throughout the state and it has shown cosmopolitan distribution. Most surprisingly West Bengal comprises only 2.7% area of India but it represents 27.04 % of total syrphid species available from the country which is quite significant. A further detailed study in different zones of this state is required to depict a clearer picture. Moreover, this is the first ever compiled list of recent time depicting the currently available species list from the state of West Bengal following the latest nomenclature pattern which may help other researchers in their study regarding this charismatic hoverflies.

**CONFLICT OF INTEREST**

The authors declare no conflict of interest.
ACKNOWLEDGEMENTS

We would like to express our heartfelt gratitude to Dr. Kailash Chandra, Director, Zoological Survey of India, Kolkata, for giving us an opportunity and providing all sorts of help to complete the survey in protected forest and adjoining areas of districts of West Bengal in proper time. We further acknowledge Dr. K.C.Gopi, Scientist ‘F’, Divisional in Charge Entomology ‘A’ & ‘B’ for giving us an opportunity for submitting this article. We are thankful for the help of DFO of concerned forests and all the forest staffs, local people is also deeply acknowledged for providing us guidance and all other necessary facilities.

LITERATURE CITED

Bugg, R. L. 2008. Flower flies (Syrphidae) and other biological control agents for aphids in vegetable crops. Published by the University of California, Division of Agriculture and Natural Resources, California, 125 pp.
Plate 1. Figures 1A-1D: 1A-Habitus of Chrysotoxum quadrifasciatum Brunetti, 1923, 1B-Habitus of Eristalinus (Eristalinus) tabanoides (Jaennicke, 1867), 1C-Habitus of Lycastris albipes Walker, 1857, 1D-Habitus of Eumerus aurifrons (Wiedemann, 1824).

Map 1a-1b: Gis Map of India; Gis Map of West Bengal indicating the collection location of 4 newly reported species of hover flies from the state.