



Diversity of Hover flies (Insecta: Diptera: Syrphidae) with 3 New Records from Shivalik Hill Zone of Himachal Pradesh, India

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Abstract

Twenty two species under 14 genera over 2 subfamilies have been reported from Shivalik hill zone of Himachal Pradesh, India. 3 species namely *Allograpta (Allograpta) javana* (Wiedemann,1824), *Dideopsis aegrota* (Fabricius,1805) and *Eristalinus (Eristalinus) tabanoides* (Jaenicke,1867) are reported for the first time from this Shivalik hill zone as well as from the state of Himachal Pradesh. Their taxonomic keys and detail diagnosis of the reported species has been discussed along with the distributional pattern of these species along the Shivalik hill zone of Himachal Pradesh.

Keywords: Hover flies, New Record, Shivalik hill zone, Syrphidae, Taxonomy.

Introduction

With approximately 6000 species worldwide (Pape et al.2019) of which 5.91% of species shared by India (Sengupta et al.2019), Hoverflies (Diptera: Syrphidae) are one of the most important second line pollinator of our country. Role of immature syrphid flies as biological pest controller is well established (Bhatia, 1933). Apart from this, the role of adult syrphids as potential pollinator (Gilbert, 2013) is also a decade long research priority all over the world (Ghahari et al. 2008). A 2016 IPBES study estimates that over 40% of the world's invertebrate pollinators are at risk of extinction including bees & butterflies (Ferrier et al, 2016). This will in turn affect the future food security of this region. In such a situation, the emergence of second line pollinator as an alternate source of pollination is highly essential. Role of hoverflies as second line

pollinator is thus becoming crucial with passing years especially in those habitat and landscape regions where pollination function rendered by honeybees are getting affected due to environmental heterogeneity and anthropogenic interferences (Graham & Gilbert, 2011). Such conditions are more prevalent in higher elevational region around the globe (Mani,2013). The upper hilly region of our country is thus also facing a threat of upcoming food scarcity due to declination of global pollination rate (Ssymank et al. 2008). The entire state of Himachal Pradesh is geographically located in upper elevation range (Mani, 2013), thereby going to face same pollination crisis issues in very near future (Potts et al., 2006). Agro economically the whole state of Himachal Pradesh is classified into 4 distinct zones (Joshi et al.

2013) namely Shivalik zone (350-650 mt), Mid hill zone (651-1800 mt), High hill zone (1801-2200 mt) and cold & dry zone (2201 to 6600 mt). Our study is concerned with the Shivalik or low hill zone of the state which was surveyed previously but scatterly no consolidated report on the account of dipteran pollinators especially syrphid flies are available from this region (Shah *et al.* 2014), which in turn was a gap area in second line pollinators research from this mountain state(). The current study accounts for 22 species of hoverflies under 14 genera over 2 subfamilies from Shivalik hill zone of Himachal Pradesh. Which further includes record of 3 species of syrphid flies namely *Allograpta (Allograpta) javana* (Wiedemann,1824), *Dideopsis aegrota* (Fabricius,1805) and *Eristalinus (Eristalinus) tabanoides* (Jaenicke,1867) for the first time from the state of Himachal Pradesh. Further detailed survey in this agro economic zone, both seasonally and in a certain periodic interval, may emphasize towards a clearer picture of this group of second line pollinators.

Materials and Methods

Collection & preservation method:

Syrphid fauna was collected from the field during day time by using insect sweep nets, different types of traps have been also used in collection including malaise trap, pan trap, UV pan trap etc. The collected samples are narcotized by using ethyl acetate and stored for further study in insect envelopes in the field. The specimens were later carried back to the laboratory, mounted on insect pins and stored in insect cabinets.

Identification of specimens:

Identification of the adults followed the keys of Thomson (2013), Vockeroth (1992, 1982, 1981) and Brunetti (1923) keeping in mind the recent nomenclatural changes (Pape and Thompson, 2019). All the identified specimens were deposited in the designated repository of National Zoological Collection, Diptera section, Zoological Survey of India, Kolkata.

Technical procedure:

The graphical representations here were made by using Microsoft Excel 2007. The 3D map of

the study area has been generated by using ARC GIS software version 10.1. The photograph of habitus and insect body and parts were taken by using Leica Microscope M205A, where 0.32x Acro lense was used for habitus photography and PLANAPO 1.0X lense was used for for the photography of body parts and Nikon D7000 (Nikkor normal and macro lens) were used for field photographs.

Result & discussion:

The current study includes the total list of available syrphid species from Shivalik hill zone of Himachal Pradesh along with their systematic account, diagnostic taxonomic key, and distributional affinity in India as well as in all other zoogeographical realms.

List of taxa

Subfamily Syrphinae

Tribe Syrphini

- I. **Genus *Allograpta*** Osten Sacken, 1875
Subgenus *Allograpta* Osten Sacken, 1875
 1. *Allograpta (Allograpta) javana* (Wiedemann, 1824)**
- II. **Genus *Asarkina*** Macquart, 1842
Subgenus *Asarkina* Macquart, 1842
 2. *Asarkina (Asarkina) ericetorum* (Fabricius, 1781)
- III. **Genus *Dideopsis*** Matsumura, 1917
 3. *Dideopsis aegrota* (Fabricius, 1805) **
- IV. **Genus *Episyrphus*** Matsumura & Adachi, 1917
Subgenus *Episyrphus* Matsumura & Adachi, 1917
 4. *Episyrphus (Episyrphus) balteatus* (De Geer, 1776)
- V. **Genus *Ischiodon*** Sack, 1913
 5. *Ischiodon scutellaris* (Fabricius, 1805)
- VI. **Genus *Sphaerophoria*** Lepeletier & Serville, 1828
Subgenus *Sphaerophoria* Wiedemann, 1830

6. *Sphaerophoria* (*Sphaerophoria scripta*) *indiana* Bigot, 1884
- VII. **Genus** *Allobaccha* Curran, 1928
Subgenus *Allobaccha* Curran, 1928
7. *Allobaccha* (*Allobaccha*) *amphithoe* (Walker, 1849)
- Tribe Bacchini**
- VIII. **Genus** *Baccha* Fabricius, 1805
8. *Baccha maculata* Walker, 1852
- IX. **Genus** *Melanostoma* Schiner, 1860
9. *Melanostoma orientale* (Wiedemann, 1824)
- Tribe Paragini**
- X. **Genus** *Paragus* Latreille, 1804
Subgenus *Paragus* Latreille, 1804
10. *Paragus* (*Paragus*) *serratus* (Fabricius, 1805)
- Subfamily Eristalinae**
- Tribe Ceriodini**
- XI. **Genus** *Sphiximorpha* Rondani, 1850
11. *Sphiximorpha triangulifera* (Brunetti, 1913)
- Tribe Eristalini**
- XII. **Genus** *Eristalinus* Rondani, 1845
Subgenus *Eristalinus* Rondani, 1845
12. *Eristalinus* (*Eristalinus*) *arvorum* (Fabricius, 1787)
13. *Eristalinus* (*Eristalinus*) *megacephalus* (Rossi, 1794)
14. *Eristalinus* (*Eristalinus*) *polychromata* (Brunetti, 1923)
15. *Eristalinus* (*Eristalinus*) *tabanoides* (Jaenicke, 1867) **
Subgenus *Eristalodes* Mik, 1897
16. *Eristalinus* (*Eristalodes*) *paria* (Bigot, 1880)
- XIII. **Genus** *Eristalis* Latreille, 1804
Subgenus *Eoseristalis* Kanervo, 1938
17. *Eristalis* (*Eoseristalis*) *cerealis* Fabricius, 1805
18. *Eristalis* (*Eoseristalis*) *himalayensis* Brunetti, 1908
Subgenus *Eristalis* Latreille, 1804
19. *Eristalis* (*Eristalis*) *tenax* (Linnaeus, 1758)
- XIV. **Genus** *Mesembrius* Rondani, 1857
Subgenus *Mesembrius* Rondani, 1857
20. *Mesembrius* (*Mesembrius*) *bengalensis* (Wiedemann, 1819)
21. *Mesembrius* (*Mesembrius*) *quadrivittatus* (Wiedemann, 1819)
- Tribe Milesiini**
- XIV. **Genus** *Syrirta* Lepeletier & Serville, 1828
22. *Syrirta pipiens* (Linnaeus, 1758)

Systematic account**Family Syrphidae**

Key to subfamily

1. Post pronotum bare, male abdominal 5th tergite visible in dorsal view.....**Syrphinae**
- Post pronotum with at least a few suberrect or appressed hairs, male abdominal 5th tergite not visible in dorsal view.....**Eristalinae**
Subfamily Syrphinae

Key to tribe

1. Abdomen usually slender in appearance.....**Bacchini**
- Abdomen usually equilateral in appearance.....2

2. Scutellum at its posterior margin with denticulate pattern, Abdomen usually robust in shape.....**Syrphini**
- Scutellum without any denticulate pattern at posterior margin, Abdomen usually slender in shape.....**Paragini**

Tribe SYRPHINI

Key to the Genera

1. Anterior anepisternum bare.....2
 - Anterior anepisternumpilose at least posterodorsally..... **Episyrrhus** Matsumura & Adachi, 1917
2. Abdomen elongate, strongly petiolate second and third tergites; laterotergite dorsally bears a patch of long pile.....**Allobaccha** Curran, 1928
 - Abdomen parallel sided to oval; not at all distinctly petiolate.....3
3. Metapleuron with a tuft of pile near spiracle; hind coxa with a tuft of pile posterolaterally; subscutellarregion with dense fringe; Katepisternum with anterior tuft of pile Metasternumpilose; veins R₄₊₅sinulate.....**Asarkina** Macquart, 1842
 - Metasternum bare ventral to spiracle; metasternum variable; veins R₄₊₅straight or sinulate.....4
4. Ground colour of scutum yellow with a sharply defined vitta extending from postpronotum to transverse suture.....5
 - Ground colour of scutum black with a most poorly defined yellow pollinose lateral vita.....6
5. Abdomen with at least a weak marginal sulcus on tergites 4 and 5 and often with a strong sulcus on tergites 3-5; anepisternum yellow posteriorly; male hind trochanter with a ventral spineor spine-like process; flagellomeresubacuate apically.....**Ischiodon** Sack, 1913
 - Abdomen without marginal sulcus; pleura with very dull but distinct well defined pale markings; hind trochanter normal; metasternumpilose.....**Allograpta** Osten Sacken, 1875
6. Wing without transverse dark fascia, unmarked except for stigmal darkening, rarely costal area longitudinally darkened.....**Sphaerophoria** Lepelletier & Serville, 1828
 - Wing with distinct transverse brown fascia at middle extending from costa to at least R-M cross veins.....**Dideopsis** Matsumura, 1917

Tribe BACCHINI

Key to the genera

1. Abdomen strongly petiolate; segment 2 & 3; very long and narrow distinctly tuberculate just above lower margin; metepisternum bare.....**Baccha** Fabricius, 1805
 1. -Abdomen parallel sided and unmarginated eyes bare; metasternum bare.....**Melanostoma** Schiner, 1860

Subfamily Eristalinae

Key to tribe

1. Hind femur with well-developed basal patch of setulae, Mesopleuron bare at anterior end.....**Eristalini**
 - Hind femur with without basal patch of setulae, Meso pleuronpilose at anterior end.....2
2. Long antennae always with a terminal style.....**Ceriodini**

- Short antennae with a bare arista.....**Milesini**

Tribe ERISTALINI

Key to the genera

1. Wing with marginal cell (R_{1+2}) narrowly open..... **Mesembrius** Rondani, 1857
 - Wing with marginal cell (R_{1+2}) closed.....2
2. Katepiternum bare, eyes densely hairy with two vertical ands of longer hairs; antennal
 2. arista with short hairs on basal half.....**Eristalis** Latreille, 1804
 - Katepiternum haired; antennal arista practically bare; eyes with dark spots; post alar Ridge with tuft of strong black hairs.....**Eristalinus** Rondani, 1845

Genus *Mesembrius* Rondani, 1857

3. Key to species

1. Fourth abdominal segment with an widely open inverted V mark; mid femur in male with a tooth below near base and suddenly constricted an apex, hind tibia, hind tibia distinctly curved with mainly black pubescence.....**bengalensis**, (Wiedemann, 1819)
 - Fourth abdominal segment without a V mark, middle femur in male without tooth below and gradually narrowed towards apex, hind tibia very suddenly narrowed near tip forming a small tooth at point of compression.....**quadrivittatus**, (Wiedemann, 1819)

Genus *Eristalis* Latreille, 1804

Key to sub genus

1. Arista bare in appearance.....;..... **Eristalis** Latreille, 1804
 - Arista hairy in appearance..... **Eoseristalis** Kanervo, 1938
- Key to the species of subgenus *Eoseristalis* Kanervo, 1938

1. Abdominal tergite 3 within male with a triangular or oblique spot on anterior margin reaching laterally in female spot smaller, narrower in the same position.....**cerealis**, Fabricius, 1805
 - Abdominal tergite without such triangular spot.....**himalayensis**, Brunetti, 1908

Genus *Eristalinus* Rondani, 1845

Key to the subgenera

1. Metathoracic spiracle dorsally with a distinct patch of hairs; eyes with longitudinal dark stripes.....**Eristalodes** Mik, 1897
 - Metathoracic spiracle in front without any patch of hairs; eyes with spots or irregular markings.....**Eristalinus** Rondani, 1845

Subgenus *Eristalinus* Rondani, 1845

1. Scutum with 5 distinct black longitudinal dust bands.....**megacephalus** (Rossi, 1794)
 - Scutum with 4 distinct black longitudinal bands.....2
2. Second, third and fourth abdominal segments all orange except for the clear cut black posterior margin and a median black stripe; no arcuate whitish band present; anterior femora long broadly; and hind femur very narrowly orange.....**polychromata** (Brunetti, 1923)

- Second to fourth abdominal segments never all orange; arcuate whitish bands normally present.....3
- 3. Femora normally all orange or brownish orange; fore and mid tibia on apical half; hind pair wholly except narrowly at base blackish.....**arvorum** (Fabricius, 1787)
- Femora black; tips generally more or less pale.....**tabanoides** (Jaenicke, 1867)

1. *Allograpta (Allograpta) javana* (Wiedemann, 1824)

1824. *Syrphus javana*
Wiedemann, *Analecta. Ent.*: 34

Type locality: Java, Indonesia.

Material examined: 2♀♀, Naina Devi, Bilaspur district, 572 mt, 31°20'26.4"N, 76°41'14.8"E, 01.ii.16, coll: J.Sengupta, 5♀♀, Sanor, Bilaspur district, 371mt, 32° 5'55.63"N, 75°43'9.29"E, 01.ii.16, coll: J.Sengupta,



Diagnosis: Antennal sockets separated by long slender scape, both scape and pedicel is ochre yellow in colour. Flagellomere is both broad and elongated. Upper surface of flagellomere is blackish. Abdomen slender in shape.

Distribution: India: **Himachal Pradesh**, Madras, Mysore.

Elsewhere: Australasian Region (S. Australia, Solomons), Neotropical Region (Formosa), Oriental Region (Borneo, Sri Lanka) Pacific Region (Fiji), Palearctic Region (China, Japan).

Remarks: This species is reported for the first time from the state of Himachal Pradesh.

2. *Asarkina (Asarkina) ericetorum* (Fabricius, 1781)

1781. *Syrphus ericetorum* Fabricius, *Spec. Insect.* 2:425

Type-locality: South Africa. Cape region

Material examined: 5♀♀, Nandpur, Una district, 501 mt, 31°37'20.34"N, 76° 8'8.85"E, 04.ii.16, coll: J.Sengupta, 2♂♂ Naina Devi, Bilaspur district, 572 mt, 31°20'26.4"N, 76°41'14.8"E, 01.ii.16, coll: J. Sengupta, 8♀♀, Bolewal, Una district, 460 mt, 31°20'52.25"N, 76°12'52.45"E, 05.ii.16, coll: J.Sengupta.

Distribution: India: Himachal Pradesh, Arunachal Pradesh, Assam, Gujarat, Jammu & Kashmir, Kerala, Manipur, Meghalaya, Mizoram, Sikkim, Tamil Nadu, Uttarakhand and West Bengal.

Distribution: Elsewhere: Afrotropical Region (Africa), Australasian Region (Australia, New Guinea), Neo tropical Region (Formosa), Oriental Region (Nepal, Srilanka, S-E Asia).

Remarks: This species is distinguished by its flat oval shaped broad abdomen.

3. *Dideopsis aegrota* (Fabricius, 1805)

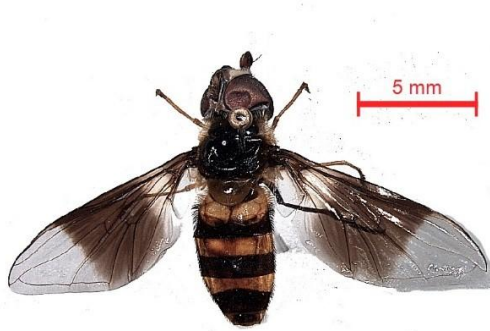
1805. *Eristalis aegrota* Fabricius, *Syst. Antliat.*:243

Type locality: Tamil Nadu: Tharangambadi.

Material examined: 2♂♂, Chintpurni, Una district, 498 mt, 31°48'0.66"N, 76° 5'44.58"E, 04.ii.16, coll: J.Sengupta, 3♀♀ Renuka Lake, Sirmour district, 650 mt, 32°33'12.1"N, 76°7'32.9"E, 15.iv.17, coll: J.Sengupta, 1♀ Karuni, Una district, 588 mt, 30°59'42.13"N, 76°45'29.74"E, 15.iv.17, coll: J.Sengupta.

Diagnosis: Flagellomere narrowly black, while scape and pedicel joint blackish in appearance. Abdominal shape flat and ovate in appearance. This species is distinguished by the presence of dark brown patches along the middle surface of

both wings. Wing is partially covered with microtrichia.



Distribution: India: **Himachal Pradesh**, Arunachal Pradesh and West Bengal.

Distribution: Elsewhere: Australasian Region (Australia, New Guinea.), Oriental Region (Borneo, Java, Malaya, Nepal, SE Asia), Palaeartic Region (China).

Remarks: This species is reported for the first time from the state of Himachal Pradesh.

4. *Epsirphus (Epsirphus) balteatus* (De Geer, 1776)

1776. De Geer, *Mem. pour. serv. Hist. Ins.* 6: 116

Type locality: Sweden

Material examined: 1♀ 3♂♂, Sannyash Ashram garden Jadla Koeri, Una district, 461 mt, 31°34'54.21"N, 76° 7'2.10"E, 04.ii.16, coll: J.Sengupta, 7♂♂, 3♀♀, Naina Devi, Bilaspur district, 572 mt, 31°20'26.4"N, 76°41'14.8"E, 01.ii.16, coll: J.Sengupta, 6♂♂, 3♀♀ Renuka Lake, Sirmour district, 650 mt, 32°33'12.1"N, 76°7'32.9"E, 15.iv.17, coll: J.Sengupta, 2♂♂, Renuka Lake, Sirmour district, 672 mt, 32°33'12.1"N, 76°7'32.9"E, 15.iv.17, coll: J.Sengupta, 4♂♂, 3♀♀ Dadahu, Sirmour district, 651 mt, 30°33'46.2"N, 77°28'12.7"E, 15.iv.17, coll: J.Sengupta, 27♀♀ 6♂♂, Bankhandi, Kangra district, 469 mt, 31°30'3.75"N, 76° 8'47.82"E, 05.ii.16, coll: J.Sengupta, 12♀♀, Thakurdwara, Kangra district, 464mt, 31°23'47.40"N, 76°13'58.89"E, 05.ii.16, coll: J.Sengupta, 12♀♀, Badal, Solan district, 598 mt, 31° 4'49.71"N, 76°46'8.33"E, 05.ii.16, coll: J.Sengupta, 3♀♀, Sanhera, Kangra district, 544 mt, 32°18'23.25"N, 75°53'0.34"E, 05.ii.16, coll: J.Sengupta, 1♀, Sihara,

Kangra district, 589 mt, 31°56'9.33"N, 76°10'29.78"E, 05.ii.16, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, West Bengal.

Distribution: elsewhere: Australasian Region (Australia), Oriental Region (Widely distributed), Palearctic Region (England).

Remarks: Irrespective of elevational gradient and habitat specificity, this species is found to be abundant throughout the study area.

5. *Ischiodon scutellaris* (Fabricius, 1805)

1805. *Scaeva scutellaris* Fabricius, *Syst.*

Antliat.: 252

Type locality: India: West Bengal.

Material examined: 2♂♂ Bankhandi Kangra district, 647mt, 31°27'15.00"N, 76°24'10.98"E, 05.ii.16, coll: J.Sengupta, 1♂ Bankhandi Kangra district, 469 mt, 31°30'3.75"N, 76° 8'47.82"E, 05.ii.16, coll: J.Sengupta, 5♀♀ Baddi Solan district, 621 mt, 30°59'8.13"N, 76°46'9.86"E, 05.ii.16, coll: J.Sengupta, 1♀, Dedo, Kangra district, 601 mt, 31°55'38.42"N, 76°12'20.94"E, 15.iv.17, coll: J.Sengupta, 1♀, Gangtha, Kangra district, 504 mt, 32°15'47.61"N, 75°50'32.13"E, 15.iv.17, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, Andhra Pradesh, Assam, Delhi, Jammu & Kashmir, Karnataka, Kerala, Meghalaya, Madhya Pradesh, Manipur, Meghalaya, Orissa, Punjab, Tamil Nadu, Tripura, and West Bengal)

Distribution: Elsewhere: Australasian Region (Australia, Pacific island), Oriental Region (Indonesia, Java), Palaeartic Region (Japan).

Remarks: This species was also quite abundant in study area.

6. *Sphaerophoria (Sphaerophoria scripta) indiana* Bigot, 1884

1884. *Sphaerophoria indiana* Bigot, *Annl.* *Soc. ent. Fr.* (6) 4: 99

Type locality: Tamil Nadu: Tharangambadi.

Material examined: 5♂♂, Naina Devi, Bilaspur district, 572 mt, 31°20'26.4"N, 76°41'14.8"E, 01.ii.16, coll: J.Sengupta, 11♂♂ Renuka Lake, Sirmour district, 650 mt, 32°33'12.1"N, 76°7'32.9"E, 15.iv.17, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, West Bengal)

Distribution: Elsewhere: Oriental Region (Japan, Korea)

Remarks: Besides *balteatus* this was one of the most abundant hoverflies which shows

distributon through out elevatonal gradient irrespective of habitat types.

7. *Allobaccha (Allobaccha) amphithoe* (Walker, 1849)

1849. *Baccha amphithoe* Walker, *Dipt. Insect.2:549*

Type locality:Tamil Nadu: Tharangambadi.

Material examined: 1♂, Naina Devi, Bilaspur district, 572 mt, 31°20'26.4"N, 76°41'14.8"E, 01.ii.16, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, Assam, Kerala, Karnataka, Meghalaya, Manipur, Mizoram, Uttarakhand, West Bengal.

Distribution: Elsewhere: Oriental Region (Burma, Japan, Sri Lanka, Taiwan).

Remarks: This species is distinguished by conspicuously constricted abdominal region.

8. *Baccha maculata* Walker, 1852

1852. *Baccha maculata* Walker, *Insect. Saund.1:223*

Type locality: East Indies

Material examined:1♂ Bankhandi Kangra district, 469 mt, 31°30'3.75"N, 76° 8'47.82"E, 05.ii.16, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, Meghalaya, Sikkim, Uttar Pradesh, Uttarakhand, West Bengal.

Elsewhere: Oriental Region (Borneo, Japan, Java, Kalimantan, Korea, Malaya, Nepal, Philippines, Sumatra, Taiwan), Palearctic Region (Russia).

Remarks: This species is distinguished by narrow abdominal region.

9. *Melanostoma orientale* (Wiedemann, 1824)

1824. *Syrphus orientalis*, Wiedemann, *Analec. Ent. : 36*

Type locality:India: Tamil Nadu: Tharangambi.

Material examined:4♀♀,13♂♂Nandpur, Una district, 501 mt, 31°37'20.34"N,76° 8'8.85"E, 04.ii.16, coll: J.Sengupta,1♂4♀♀, Naina Devi, Bilaspur district, 572 mt, 31°20'26.4"N, 76°41'14.8"E, 01.ii.16, coll: J.Sengupta.1♂ Renuka Lake, Sirmour district, 650 mt, 32°33'12.1"N, 76°7'32.9"E, 15.iv.17, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, Assam, Arunachal Pradesh, Jammu & Kashmir, Karnataka, Meghalaya, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, and West Bengal.

Distribution: elsewhere: Oriental Region (Bhutan, Nepal, Pakistan, Sri Lanka)

Remarks: This species is distinguished by presence of two central bump in facial region.

10. *Paragus (Paragus) serratus* (Fabricius, 1805)

1805. *Mulio serratus* Fabricius, *Syst. Antliat.3:186*

Type locality:India. Tamil Nadu: Tharangambadi.

Material examined:4♀♀, Churu, Una district, 461 mt, 31°34'54.21"N, 76° 7'2.10"E, 04.ii.16, coll: J.Sengupta,1♀, Suti, Una district, 604 mt, 31°46'51.38"N, 76°15'27.19"E, 04.ii.16, coll: J.Sengupta,7♂♂, Sannyash Ashram garden, Una district, 461 mt, 31°34'54.21"N, 76° 7'2.10"E, 04.ii.16, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, Assam, Bihar, Delhi, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Punjab, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal)

Distribution: Elsewhere: Oriental Region (Africa, Borneo, Java, Nepal, Pakistan, Papuya, Sri Lanka)

Remarks: This species is distinguished by conspicuously serrated area on dorsal surface of scutellum.

11. *Sphiximorpha triangulifera* (Brunetti, 1913)

1913. *Ceria triangulifera* Brunetti, *Rec. Indian Mus.9: 273*

Type locality: Darjeeling District, India

Material examined: 1♀, Thakur dwara, Kangra district, 498 mt, 31°48'0.66"N, 76° 5'44.58"E, 04.ii.16, coll: J.Sengupta,1♂, Bankhandi, Kangradistrict, 535 mt, 31°32'3.06"N, 76°15'36.42"E, 04.ii.16, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, West Bengal

Distribution: elsewhere: NIL

Remarks: This species usually show several intra species variation especially in the leg colour. Besides this species is endemic to state of Himachal Pradesh.

**12. *Eristalinus (Eristalinus) arvorum*
(Fabricius, 1787)**

1787. *Syrphus arvorum* Fabricius, *Mantissa insectorum*.2, [2]: 335

Type locality: Tamil Nadu: Tharangambadi.

Material examined: 7 ♀♀, Nandpur, Una district, 501 mt, 31°37'20.34"N, 76°8'8.85"E, 04.ii.16, coll: J.Sengupta, 5 ♀♀, Dhabota, Solan district, 531mt, 31°3'56.94"N, 76°39'9.32"E, 01.ii.16, coll: J.Sengupta, 8 ♂♂1♀, Churu, Una district, 500 mt, 31°35'24.34"N, 76°9'18.50"E, 04.ii.16, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, Tamil Nadu.

Elsewhere: Afro tropical region (Seychelles), Australasian region (Australia), Oriental Region (China, Entire SE Asia, Japan), Indo Australian region (Hawaii, Micronesia, Palearctic region (Mariana)

Remarks: This species shows morphological differences gender wise, in male the abdominal region is short, ovate shaped whereas the female species possess long narrow conical abdomen.

13. *Eristalinus (Eristalinus) megacephalus* (Rossi, 1794)

1794. *Syrphus megacephalus* Rossi, *Mantissa insectorum*.2: 63

Type locality: Italy.

Material examined: 1 ♂, Chabutar village, Hamirpur district, 646 mt, 31°41'10.2"N, 76°31'16.7"E, 02.ii.16, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**,

Distribution: Elsewhere: Afro tropical region (South Africa), Indo Australian region (Guam), Palearctic region (Egypt), Oriental Region (China, Java, Sri Lanka, Taiwan).

Remarks: This species is distinguished by narrow conical abdomen along with uniformly dotted eyes.

**14. *Eristalinus (Eristalinus) polychromata*
(Brunetti, 1923)**

1923. *Eristalis polychromata* Brunetti, *Fauna of British India*.3: 180

Type locality: India: Kolkata.

Material examined: 1 ♂, Natural water stream, Una district, 481 mt, 31°47'1.29"N, 76°3'28.20"E, 04.ii.16, coll: J.Sengupta, 2 ♀♀, Tikkar, Una district, 606 mt, 31°45'18.40"N, 76°16'4.34"E, 04.ii.16, coll:

J.Sengupta, 2 ♀♀, Natural water stream, Una district, 567 mt, 30°29'59.98"N, 77°13'0.51"E, 04.ii.16, coll: J.Sengupta, 1 ♀, Golaji Temple, Una district, 464 mt, 31°23'47.40"N, 76°13'58.89"E, 04.ii.16, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, West Bengal

Distribution: Elsewhere: Nil.

Remarks: This species is endemic to state of Himachal Pradesh.

**15. *Eristalinus (Eristalinus) tabanoides*
(Jaenicke, 1867)**

1867. *Eristalis tabanoides* Jaenicke, *Neu. exot. Dipteren. Abh. Senckenb. Ges.* 6: 402

Type locality: Eritrea.

Material examined: 10 ♀♀, Parla, Una district, 647 mt, 31°27'15.00"N, 76°24'10.98"E, 04.ii.16, coll: J.Sengupta, 6 ♂♂, Dhabota, Solan district, 531 mt, 31°3'56.94"N, 76°39'9.32"E, 15.iv.17, coll: J.Sengupta, 11 ♀♀, Dhabota, Solan district, 531 mt, 31°3'56.94"N, 76°39'9.32"E, 15.iv.17, coll: J.Sengupta, 12 ♀♀, Dhabota, Solan district, 583 mt, 30°30'14.93"N, 77°13'16.28"E, 15.iv.17, coll: J.Sengupta, 1 ♂, Sanor, Solan district, 371 mt, 32°5'55.63"N, 75°43'9.29"E, 15.iv.17, coll: J.Sengupta, 1 ♂, Dedo, Kangra district, 601 mt, 31°55'38.42"N, 76°12'20.94"E, 15.iv.17, coll: J.Sengupta, 2 ♂♂, Gangtha, Kangra district, 504 mt, 32°15'47.61"N, 75°50'32.13"E, 15.iv.17, coll: J.Sengupta, 2 ♂♂, Suti, Kangra district, 604 mt, 31°46'51.38"N, 76°15'27.19"E, 15.iv.17, coll: J.Sengupta, 1 ♂, Bhaner, Kangra district, 507 mt, 31°54'35.26"N, 76°1'14.29"E, 15.iv.17, coll: J.Sengupta, 2 ♀♀, Nandpur, Una district, 501 mt, 31°37'20.34"N, 76°8'8.85"E, 04.ii.16, coll: J.Sengupta.

Diagnosis: Flagellomere blackish with bare dorsal arista. Occiput ash grey as well as dusted with ash white spurs. Thorax ash grey in colour with 4 longitudinal stripes on dorsal end. Pre coxal bridge usually absent. Scutellum pale ochre yellow in colour with brownish yellow hairs on dorso lateral marginal area. Abdomen dark colored, abdominal spiracle 1 present in an area which is in anteroventral extension of tergite 1 whereas 2-7 tergites in membranous area between corresponding tergite and sternites. Abdominal bands greyish white in colour.



Distribution: India: **Himachal Pradesh**, Delhi, West Bengal.

Distribution: Elsewhere: Afro tropical region (Eritrea, Djibouti), Palearctic region (Egypt, Tunisia).

Remarks: This species is reported for the first time from the state of Himachal Pradesh.

16. *Eristalinus (Eristalodes) paria* (Bigot, 1880)

1880. *Eristalomyia paria* Bigot, *Ann. Soc. Ent. Fr. ser. 5*, **10**: 218

Type locality: Sri Lanka.

Material examined: 3♂♂ Naina Devi, Bilaspur district, 572 mt, 31°20'26.4"N, 76°41'14.8"E, 01.ii.16, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, Arunachal Pradesh, Chandigarh, Jammu & Kashmir Karnataka, Manipur, Meghalaya, Mizoram, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal.

Distribution: elsewhere: Oriental Region (Sri Lanka, Taiwan), Indo-Australian Region (Java, Moluccas)

Remarks: This species is distinguished by the presence of longitudinal stripes on eye.

17. *Eristalis (Eoseristalis) cerealis* Fabricius, 1805

1805. *Eristalis cerealis* Fabricius, *Syst. Antliat.***14**: 232

1880. *Eristalis barbata* Bigot, *Ann. Soc. Ent. Fr. ser. 5*, **10**:214

Type locality: China.

Material examined: 1♂ Renuka Lake, Sirmour district, 650 mt, 32°33'12.1"N, 76°7'32.9"E, 15.iv.17, coll: J.Sengupta, 1♂ Renuka Lake, Sirmour district, 672 mt, 32°33'12.1"N, 76°7'32.9"E, 15.iv.17, coll: J.Sengupta, 1♂, Naina Devi, Bilaspur district, 572 mt, 31°20'26.4"N, 76°41'14.8"E, 01.ii.16, coll: J.Sengupta, 1♂, Chabutar Village, Hamirpur district, 649 mt, 31°41'10.2"N, 76°41'14.8"E, 02.ii.16, coll: J.Sengupta,

Distribution: India: **Himachal Pradesh**, Assam, Jammu & Kashmir, Meghalaya, Sikkim, Tamil Nadu, West Bengal.

Distribution: elsewhere: Widespread in Oriental region, Palearctic region (Russia)

Remarks: This species is distinguished from *tenax* by hairy arista. This species is also widely distributed in upper elevation zone.

18. *Eristalis (Eoseristalis) himalayensis* Brunetti, 1908

1908. *Eristalis himalayensis* Brunetti, *Rec. Indian Mus.***2**:70

Type locality: Indostan

Material examined: 2♀♀, Naina Devi, Bilaspur district, 572 mt, 31°20'26.4"N, 76°41'14.8"E, 01.ii.16, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, Arunachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand, West Bengal

Distribution: elsewhere: Oriental Region (China, Java, Myanmar, Nepal Sri Lanka). Indo-Australian Region (Malaya, Philippines, Sumatra, Sumbawa.)

Remarks: This species is more common in higher elevational zone along Himalayan region.

19. *Eristalis (Eristalis) tenax* (Linnaeus, 1758)

1758. *Musca tenax* Linnaeus, *Syst. Nat. Ed.* **10**: 591

1924. *Eristalis claripes* Abreu, *Mems R. Acad. Cienc. Artes.* **19**(1): 104

Type locality: Europe

Material examined: 3♂♂, 1♀ Renuka Lake, Sirmour district, 650 mt, 32°33'12.1"N, 76°7'32.9"E, 15.iv.17, coll: J.Sengupta, 5♂♂, 10♀♀ Naina Devi, Bilaspur district,

572 mt, 31°20'26.4"N, 76°41'14.8"E, 01.ii.16, coll: J. Sengupta.

Distribution: India: **Himachal Pradesh**, Arunachal Pradesh, Chandigarh, Jammu & Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Punjab, Sikkim, Uttarakhand, West Bengal.

Distribution: elsewhere: Australasian Region (Australia, New Zealand), Indo-Australian Region (Hawaii), Palaearctic Region (China, Japan), Oriental Region (Myanmar, Pakistan, Sri Lanka).

Remarks: This species is reported to cause accidental genital myiasis in human from Iran in the year 2010. (Gonzalez et.al, 2009).

20. *Mesembrius*(*Mesembrius*) *bengalensis* (Wiedemann, 1819)

1819. Wiedemann, *Eristalis bengalensis* Besch. *Zweifel. Zool. Mag.* **1**(3): 16

Type locality: India: West Bengal.

Material examined: 1♂ Renuka Lake, Sirmour district, 650 mt, 32°33'12.1"N, 76°7'32.9"E, 15.iv.17, coll: J.Sengupta, 1♀ Nandpur, Shimla district, 583 mt, 30°30'14.93"N, 77°13'16.28"E, 05.ii.16, coll: J.Sengupta, 4♀♀, 1♂ Thakurdwara, Kangra district, 464 mt, 31°23'47.40"N, 76°13'58.89"E, 05.ii.16, coll: J.Sengupta,

Distribution: India: **Himachal Pradesh**, Andhra Pradesh, Assam, Bihar, Chandigarh, Gujrat, Karnataka, Punjab, Tamil Nadu, West Bengal.

Distribution: elsewhere: Australasian Region (Australia, New Guinea)

Remarks: This species is distinguished by its nearest resemblance *quadrivittatus* by the presence of spine in hind leg region.

21. *Mesembrius* (*Mesembrius*) *quadrivittatus* (Wiedemann, 1819)

1819. Wiedemann, *Eristalis quadrivittatus*. **1**(3): 17

Type locality: India: Tamil Nadu: Tharangambi

Material examined: 3♀♀, Bankhandi, Kangra, 469 mt, 31°30'3.75"N, 76° 8'47.82"E, 05.ii.16, coll: J.Sengupta, 3♀♀, 2♂♂ Thakurdwara, Kangra district, 464 mt, 31°23'47.40"N, 76°13'58.89"E, 05.ii.16, coll: J.Sengupta, 1♀, Kuriala, Una district, 488 mt, 31°44'6.87"N, 76° 4'38.81"E, 05.ii.16, coll: J.Sengupta, 1♀, Sannyash Ashram garden, Una district, 481 mt, 31°47'1.29"N, 76° 3'28.20"E, 05.ii.16, coll: J.Sengupta, 1♂, Ramgarh Parla, Shimla

district, 501 mt, 31°37'20.34"N, 76° 8'8.85"E, 05.ii.16, coll: J.Sengupta.

Distribution: India: **Himachal Pradesh**, Andhra Pradesh, Bihar, Chandigarh, Gujrat, Karnataka, Madhya Pradesh, Orissa, Tamil Nadu, West Bengal.

Distribution: elsewhere: Oriental Region (Java, Moluccas)

Remarks: This species is distinguished by its nearest resemblance *bengalensis* by the absence of spine in hind leg region.

22. *Syritta pipiens* (Linnaeus, 1758)

1758. *Musca pipiens* Linnaeus, *Systema naturae*.1: 594

Type locality: Europe

Material examined: 1♂, 3♀♀ Naina Devi, Bilaspur district, 572 mt, 31°20'26.4"N, 76°41'14.8"E, 01.ii.16, coll: J.Sengupta.

Distribution: India: Himachal Pradesh, Jammu & Kashmir, Uttarakhand, Uttar Pradesh and West Bengal.

Distribution: elsewhere: Nearctic Region (California & Florida), Neotropical region (British Columbia, Mexico)

Remarks: This species is distinguished by the highly swollen area of hind leg.

Discussion:

Unfortunately studies on pollinating communities usually focused on bumble bees, honey bees, solitary bees and butterflies. That's why conservation strategies and management plan has also centered around this taxon, especially in higher elevational areas. The present studies thus have focused on the availability of one of the major group of alternative pollinating flies: Syrphidae from Shivalik hill zone of Himachal Pradesh. Altogether 22 species under 14 genera over 2 subfamilies have been reported from this zone (figure 2). Among subfamilies Syrphinae (0.6) has shown a higher relative abundance value than Eristalinae (0.39) (figure 3,5,7). Relative abundance calculation among Syrphinae subfamily has shown that tribe Syrphini exhibited the maximum abundance (0.81) while Paragini has shown the least value (.06) (figure 4). On the other hand in Eristalinae subfamily Eristalini tribe has shown the maximum relative abundance value (0.95) while Milesini (0.03) has shown the least value

(figure 6). Among the reported species *E balteatus* found to be most abundant whereas *E megacephalas*, *B maculata* and *A amphithoe* exhibited the least abundance. 3 species found to be new record from the state, species whereas 2 species found to be endemic to state of Himachal Pradesh. Among 22 species 59.09% of total available syrphid has shown distributional affinity towards Palearctic region, 54.54% of total available

syrphid species shown distributional affinity towards Australian region, 4.54% of total available syrphid species shown distributional affinity towards Nearctic region and 9.09% towards Neo tropical region and 13.63% towards Afro tropical region, whereas only 22.72% of total available syrphid species shows confinement in distribution within Oriental region.

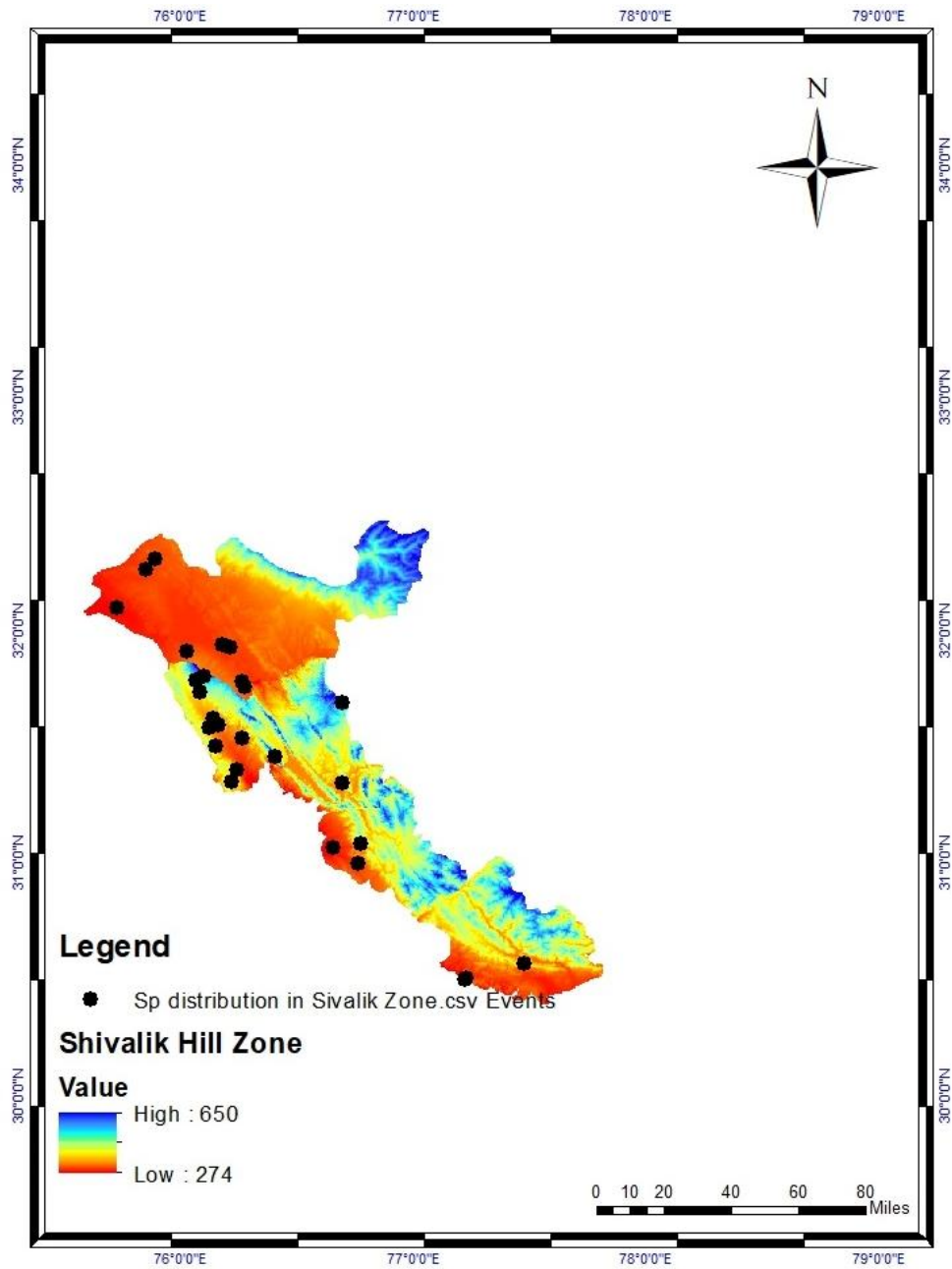


Figure 1: 3D Map showing study area and syrphid species distribution from Shivalik zone from the state of Himachal Pradesh.

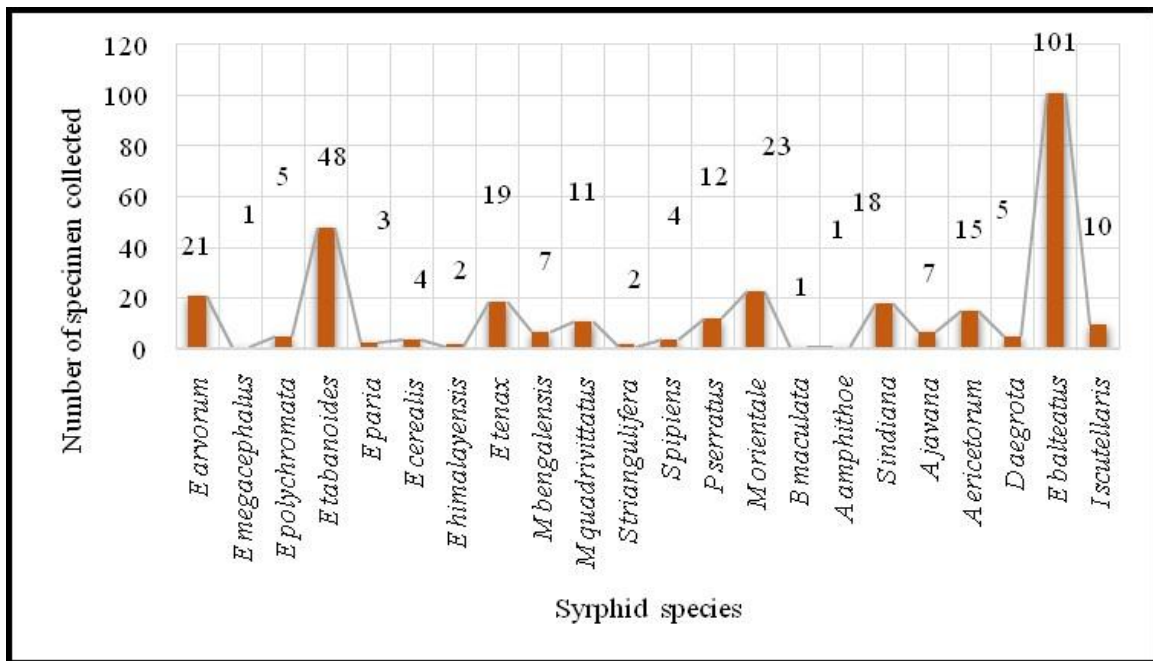


Figure 2. Abundance status of syrphid species from Shivalik Zone, Himachal Pradesh

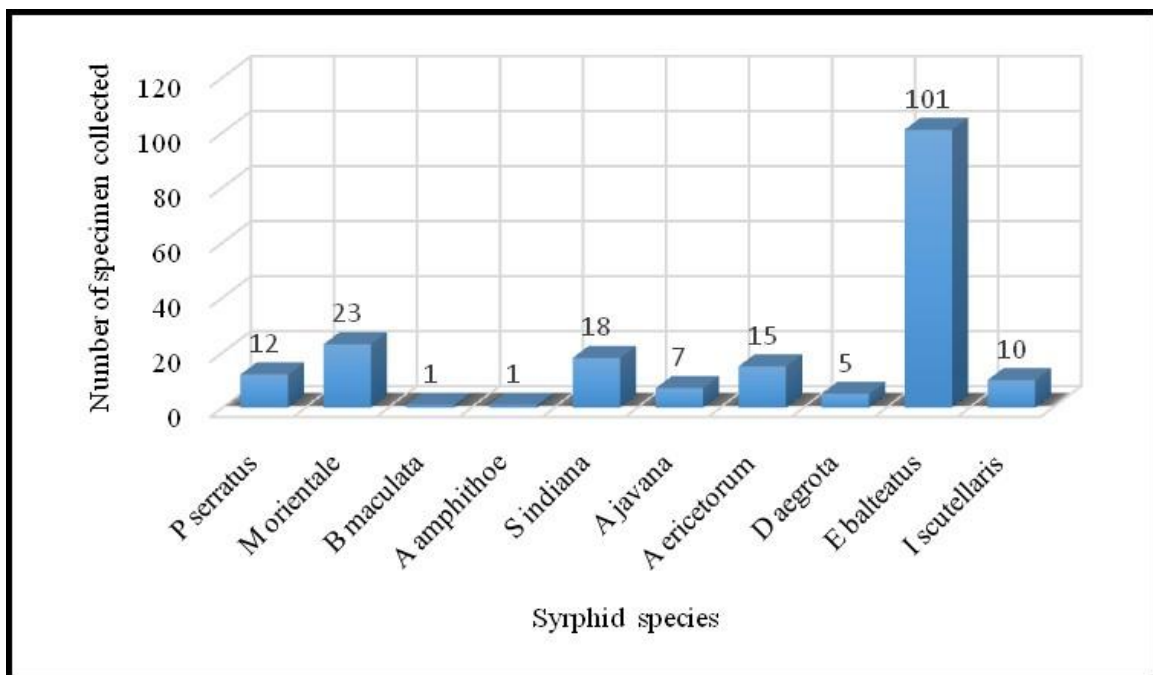


Figure 3 Abundance status of species belonging to Syrphinae subfamily from Shivalik Zone, Himachal Pradesh

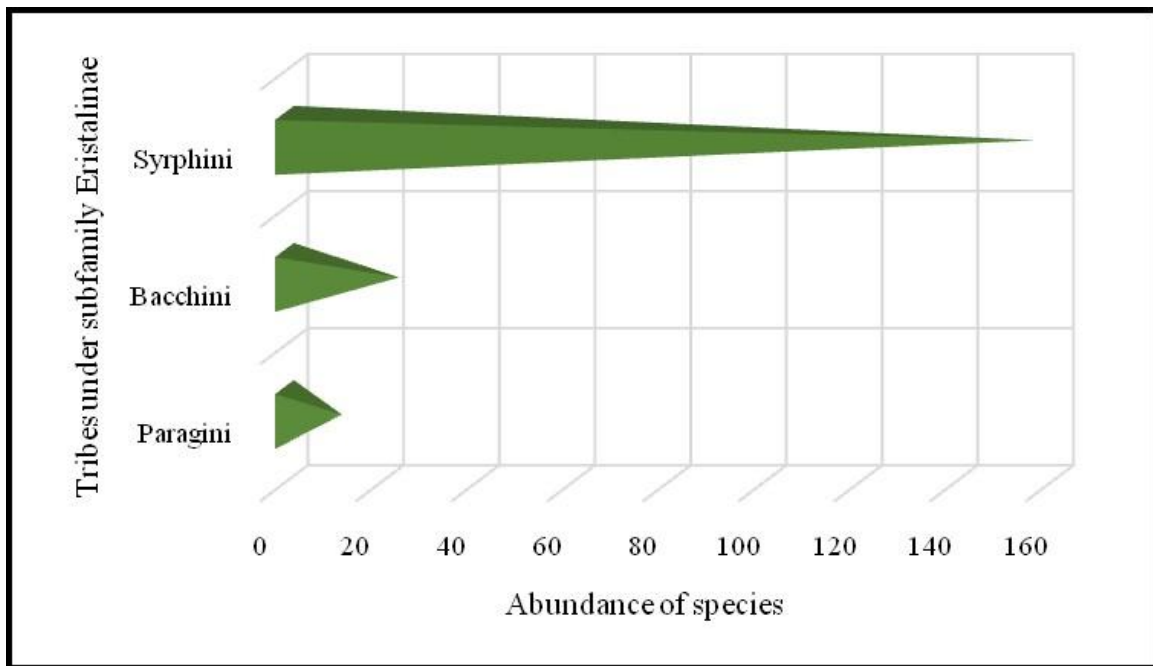


Figure 4: Abundance status of different tribes under Syrphinae subfamily from Shivalik Zone, Himachal Pradesh

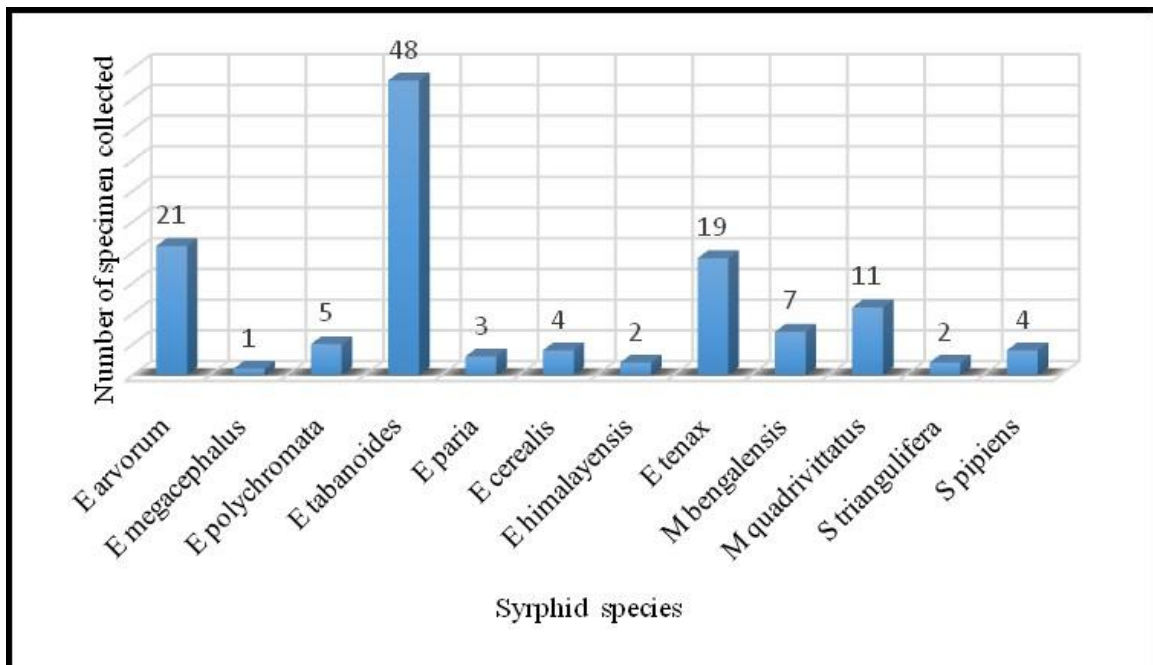


Figure 5: Abundance status of species belonging to Eristalinae subfamily from Shivalik Zone, Himachal Pradesh

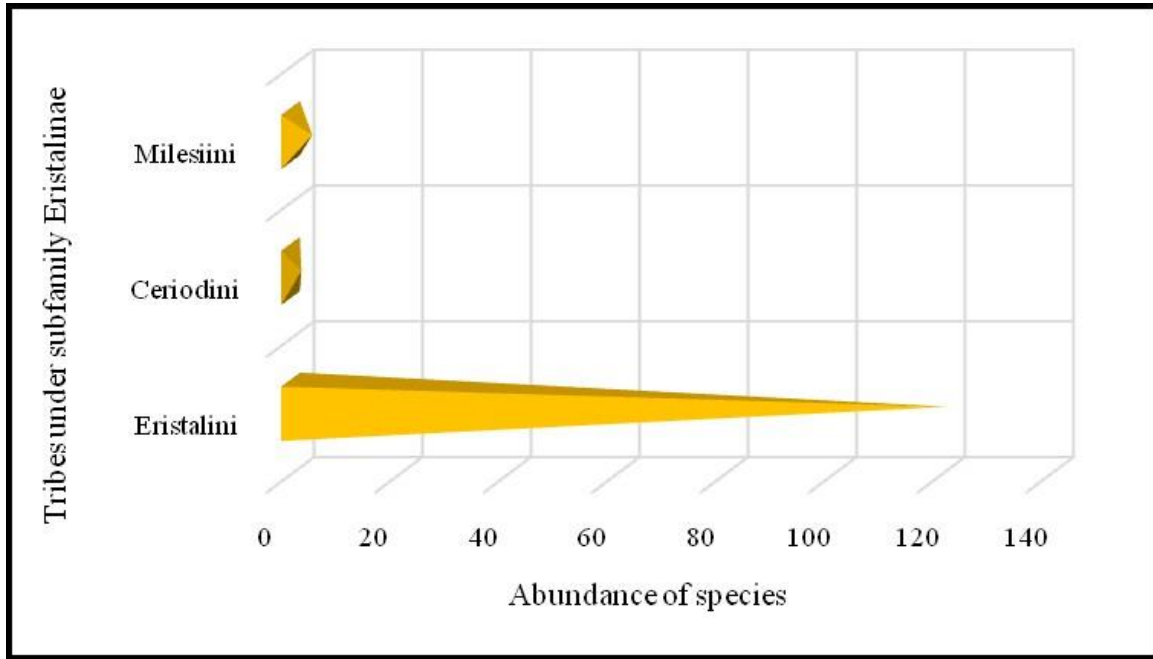


Figure 6 : : Abundance status of different tribes under Eristalinae subfamily from Shivalik Zone, Himachal Pradesh

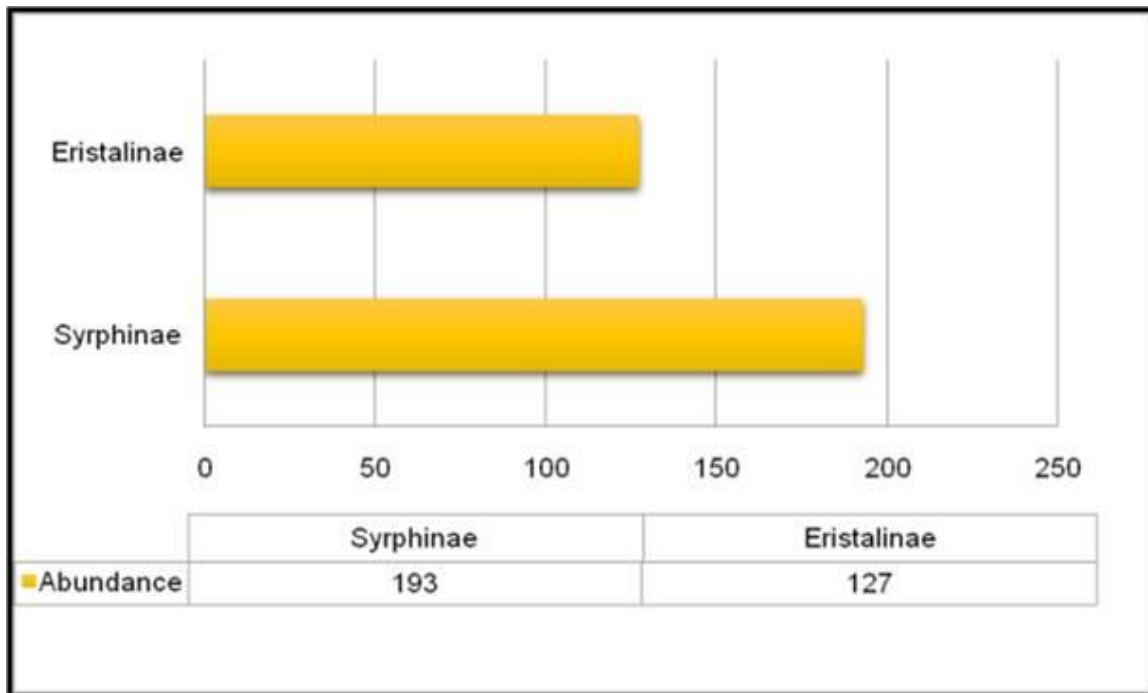


Figure 7 : Comparative account of Abundance status of two subfamilies from Shivalik Zone, Himachal Pradesh.

Such a wide distributional range of the hoverfly species suggested towards a healthy

agricultural picture from this region. Further studies from this region in periodic

intermission and in seasonal interval will lead to a clearer account of this second line pollinators.

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