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## Some Interesting Sandflies of Subgenera *Phlebotomus* Rondani and Berte in Rondani (1840) and *Parratomyia* Theodor (1948) (Diptera, Psychodidae) from Pakistan

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**Abstract :** During entomological surveys conducted in the whole of Balochistan, Pakistan during 1996-2001, four female flies of the subgenus *Phlebotomus* Rondani and Berte and 2 flies of the subgenus *Parratomyia* Theodor were collected and these are described, measured and illustrated. Their taxonomic affinity is also discussed. Morphometrically, these flies are found to differ significantly from their closest allies of the subgenera. Accordingly, these flies are treated here as species [A], [B], [C], [D] and [A] of the subgenera *Phlebotomus* and *Parratomyia*, respectively.

**Key words:** Sandfly, subgenera *Phlebotomus*, *Parratomyia*

### INTRODUCTION

A taxonomic study for the identification of the species of sandflies was carried out by the author in Pakistan during 1996-2001 and collected 2013 sandflies comprising of genera *Phlebotomus*, *Sergentomyia* and *Grassomyia*<sup>[1]</sup>. The present study deals with the four undetermined sandflies of the subgenera *Phlebotomus* and 2 of *Parratomyia* collected during the present study and these are described and illustrated here.

For collection, processing, preservation, dissection, mounting of the specimens and observation of external and anatomic parts of the sandflies, the conventional techniques especially those used by Johnson *et al.*<sup>[2-6]</sup> were followed. For the species identification of sandflies, keys furnished by Artemiev<sup>[7-10]</sup> were consulted. Measurements are in millimeter (mm). All the diagrams were drawn with the camera lucida and are to the given scales. Specimens are housed in the Author's collection of sandflies, Department of Zoology, University of Balochistan, Quetta, Pakistan.

### Taxonomic affinity

**Genus:** These four ♀ flies lack a cibarial pigment patch, cibarial teeth are absent but in the form of spicules and not in a definite row. The female has erect hairs on abdominal tergites 2-6<sup>[7,9]</sup>. These characters place these flies in the genus *Phlebotomus* Rondani and Berti in Rondani<sup>[11]</sup>.

**Subgenus:** The female pharyngeal armature has ridges of denticulations and spermatheca is completely segmented,

with wide head and head not separated from proximal segments<sup>[7-9]</sup>. These characters place these flies in the subgenus *Phlebotomus*.

***Phlebotomus* (*Phlebotomus*) Sp. [A]:** A single ♀ sandfly was collected through sucking tube by the author on 02-3-2001 from the wall of the Class Room of Government High School Lehri, Balochistan. Wing 1.92 mm long, 0.6 mm broad, =0.44 mm, =0.24 mm, =0.16, =0.36 mm, =0.08 mm, alar index=1.83. Total length of palp=0.81 mm, palp formula 1, 4, 2, 3, 5 and palp ratio 1: 3.5: 4.5: 3. 25: 8. P3 has about 15 conspicuous Newstead's sensilla on basal third of the segment. Antenna 3 (Fig. 1A) 0.21 mm long, ascoid 0.068 mm long, position of ascoid =0.71, ascoid 3/A3=0.285, position of a single papilla on A3=0.95. A4 (Fig. 1B, lower) 0.106 mm long, ascoid 0.062 mm long, position of ascoid=0.28, ascoid 4/A4=0.584, position of a papilla on A4=0.66. A5 (Fig. 1B, upper) 0.104 mm long, ascoid 0.062 mm long, position of ascoid=0.24, ascoid 5/A5=0.596, position of a single papilla on A5=0.47. There are two ascoids on segments III to XV. Labrum (Fig. 1C) 0.27 mm long, 0.032 mm broad and a sensilla depth 0.056. Hypopharynx (Fig. 1D) 0.021 mm broad and a dental depth of 0.048 mm. Maxilla (Fig. 1E) with nine lateral teeth (3 larger and six smaller) and 24 ventrals and a dental depth 0.096 mm. Mandible (Fig. 1F) 0.02 mm broad, 3 teeth per 0.004 mm and a dental depth of 0.052 mm. Cibarium (Fig. 1G) 0.052 mm broad, chitinous arch developed, spicules and denticles absent. Pharynx (Fig. 1H) 0.23 mm long, pharynx is not so markedly dilated posteriorly as in other species of subgenus *Phlebotomus* reported in the existing published literature.

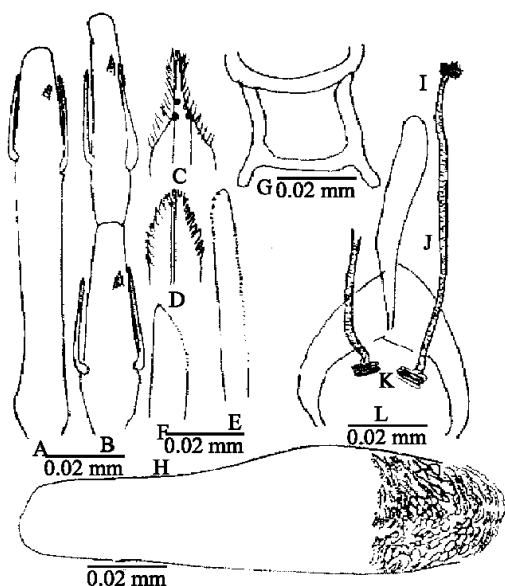


Fig. 1: Camera Lucida drawings of *Phlebotomus* (*Phlebotomus*) Sp. [A] (1♀) from Lehri showing: the third (A), fourth (B, lower) and the fifth (B, upper) antennal segments labrum (C), hypopharynx (D), maxilla (E), mandible (F) cibarium (G), pharynx (H), spermatheca (I), ducts (J), base of ducts (K), genital atrium (Fig. 1L)

It is about 3.28 times as long as broad and its widest posterior portion is not quite 1.75 times as the narrowest anterior part. The foremost and basal armature consisted of short ridges with punctiform small teeth whereas the median part of the armature is armed with numerous relatively less broad scale like teeth. Pharyngeal armature occupies 0.30 of the pharynx. Capsule of spermatheca (Fig. 1I) very short, Segments are short and very narrower but compact. Ducts long (0.19 mm) and transversely striated (Fig. 1J) with separate openings into genital atrium, base of the ducts were swollen (Fig. 1K), furca 0.12 mm long and genital atrium 0.06 mm broad (Fig. 1L).

**Male:** Not came in present collection.

**Type locality:** A single ♀ sandfly was collected through sucking tube by the author on 02-3-2001 from the wall of the Class Room of Government High School Lehri, Balochistan.

**Remarks:** This undetermined fly described here is different with the known species of the subgenus: *Ph. papatasi*, *Ph. bergeroti* and *Ph. salehi*. The following characters separate this specimen A from each other.

1. Alar index is quite high (1.83) in specimen A as compared with that of other species of the subgenus (*Ph. papatasi*=1.395-1.6; *Ph. bergeroti*=1.5-1.75; *Ph. salehi*=1.56-1.6).
2. A3/A4+5 larger in *Ph. papatasi* (0.187), *Ph. bergeroti* (1.04-1.128), *Ph. salehi* (1.0), but smaller in the specimen A (0.92).
3. Pharyngeal armature more developed but not pointing backward in *Ph. papatasi*; central part blunt, more pigmented and arranged obliquely and pointing backward in *Ph. bergeroti*; anterior armature composed of triangular or quadrate scales in *Ph. salehi* but in specimen A, the foremost and basal armature consists of short ridges with punctiform small teeth whereas the medial part armed with numerous less broad scales.
4. The morphology of labrum is also different: 2 long median apical blade-like stout sensilla, sensilla depth=0.048 mm in *Ph. papatasi*; 2 short apical hair-like blade sensilla, sensilla depth=0.052 mm in *Ph. bergeroti*; 2 short apical sensilla, sensilla depth=0.046 mm in *Ph. salehi* but sensilla depth=0.056 mm in the specimen A.
5. The morphology of hypopharynx is quite different: apex pointed with 2 apical and 16 teeth on each side, dental depth=0.056 mm in *Ph. papatasi*; 3 apical pointed teeth and 18 strongly undulating lateral teeth, dental depth=0.04 mm in *Ph. bergeroti*; quite broader 0.028 mm, 3-4 short apical teeth and 13 relatively longer lateral teeth, dental depth=0.028 mm in *Ph. salehi* but hypopharynx less broad (0.021 mm) and dental depth of 0.048 mm in the specimen A.
6. The morphology of mandible different: narrow 0.014 mm broad, with 7 small fine re-curved teeth per 0.01 mm and a dental depth of 0.06 mm in *Ph. papatasi*; 0.01 mm broad with 4 strongly re-curved teeth per 0.004 mm and a dental depth of 0.042 mm in *Ph. bergeroti*; 31 small re-curved teeth and a dental depth of 0.04 mm in *Ph. salehi* but 3 teeth per 0.004 mm and a dental depth of 0.052 mm in the specimen A.
7. Cibarium without spicules and denticles, in the specimen A, but in *Ph. papatasi*, *Ph. bergeroti* and *Ph. salehi* spicules and denticles are present in the cibarium.
8. The morphology of spermatheca quite different: cylindrical and larger in *Ph. papatasi*; cylindrical shorter in *Ph. bergeroti*; spermatheca narrowing towards the base in *Ph. salehi* but spermathecal capsule very small, narrow and compact with very narrow segments in the specimen A.

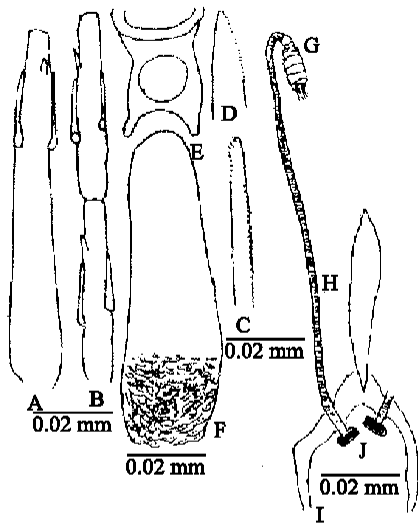


Fig. 2: Camera Lucida drawings of *Phlebotomus (Phlebotomus)* Sp. [B] (1♀) from Kahan showing: the third (A), fourth (B, lower) and the fifth (B, upper) antennal segments maxilla (C), mandible (D), cibarium (E), pharynx (F) spermatheca (G), ducts (H), genital atrium (I), base of ducts (J)

The above mentioned differences separate this specimen from the already known species of the subgenus. Accordingly it is regarded as undetermined Sp. [A].

***Phlebotomus (Phlebotomus)* Sp. [B]:** Wing 1.7 mm long, 0.504 mm broad, =0.28 mm, =0.24 mm long, =0.04 mm, =0.36 mm long, =0.08 mm, alar index 1.16. Total length of palp=0.72 mm, palp ratio 1:3:4:3:7 and palp formula 1, 2-4, 3, 5. Antenna 3 (Fig. 2A) 0.18 mm long, ascoid =0.036 mm long, position of ascoid on A3 0.66, ascoid 3/A3=0.2, position of a single papilla on A3=0.88. A4 (Fig. 2B, lower) 0.104 mm long, ascoid 4=0.04 mm long, position of ascoid on A4=0.23, ascoid 4/A4=0.38, position of a single papilla on A4=0.71. A5 (Fig. 2B, upper) 0.10 mm long, ascoid 5=0.04 mm long, position of ascoid on A5=0.26 mm, ascoid 5/A5=0.4, position of a single papilla on A5=0.76. There are two ascoids at segments III to XV. A3/A4+5=0.88, A3/labrum 0.75. Labrum 0.24 mm long, 0.032 mm broad and a sensilla depth 0.048 mm. Hypopharynx with a dental depth of 0.042 mm. Maxilla (Fig. 2C) with 8 lateral teeth (3 bigger and five smaller) and 17 ventrals, a dental depth of 0.08 mm. Mandible (Fig. 2D) 0.016 mm broad, seven teeth per 0.01 mm and a dental depth of 0.052 mm. Cibarium (Fig. 2E) 0.042 mm broad, chitinous arch developed, teeth and denticles absent. Pharynx (Fig. 2F) was stout in character and not so markedly dilated posteriorly as in other related species viz., *Ph. papatasi*,

*Ph. salehi*, *Ph. bergeroti*, its greatest width posteriorly was about 1.57 times that of the narrower anterior portion and its length is about 3 times its greatest breadth. Pharyngeal armature occupies 0.33 of the length of the pharynx and consists of two groups of teeth. Long triangular teeth in foremost two thirds and ridges of denticulations in centro posterior area. Spermatheca (Fig. 2G) 5-6 segmented, capsule 0.024 mm long, collar thin, first proximal segment is narrowest, the second and third were relatively broader and larger, remaining three distal segments are of the equal length but narrower and the last distal segment is quite small, ducts (Fig. 2H) longer (0.16 mm long) with transverse striations, open separately into genital atrium which was 0.056 mm broad (Fig. 2I), base of the duct swollen (Fig. 2J), furca 0.008 mm long. Armature in genital atrium is also observed: a batch of spines (0.04 mm long, 0.009 mm broad, a longer spine (0.004 mm) are observed. Spines are observed in groups of 2-3.

**Male:** Not came in present collection.

**Type locality:** A single ♀ sandfly was caught on 08-03-2001 by the author through sticky trap from Levies quarters at Kahan, Balochistan.

**Remarks:** This specimen is different from other species of the subgenus *Phlebotomus*. The following characters separate this specimen from other known species.

1. Alar index ratio is quite high in *Ph. papatasi* (1.395-1.6), *Ph. bergeroti* (1.5-1.75) *Ph. salehi* (1.56-1.6) but low in the specimen B (1.16).
2. A3/A4+5 ratio is larger in *Ph. papatasi* (1.14), *Ph. bergeroti* (1.04-1.128), *Ph. salehi* (1.0) but quite small in the specimen B (0.75).
3. Anterior breadth of pharynx / posterior breadth ratio is greater in *Ph. papatasi* (2.0-2.25), *Ph. bergeroti* (2.2-2.35), *Ph. salehi* (1.7-1.82) but quite short in the specimen B (1.57).
4. Mandible in *Ph. papatasi* (0.014 mm broad, with 7 small, fine re-curved teeth per 0.01 mm and a dental depth of 0.06 mm), *Ph. bergeroti* (with 4 strongly re-curved teeth per 0.004 mm and a dental depth of 0.042 mm), *Ph. salehi* (with blunt tip, 31 small re-curved) but in the specimen B, teeth arrangement quite different (7 teeth per 0.01 mm).
5. Maxilla in *Ph. papatasi* (with 7 dot like lateral teeth-6 more prominent and 1 weak, 19 ventral teeth and a dental depth of 0.108 mm), *Ph. bergeroti* (6 lateral-3 prominent, 3 weak, 20 ventral teeth, a dental depth of 0.1 mm) but in the specimen B maxilla with 8 lateral teeth 3 bigger and five smaller, 17 ventrals and a dental depth of 0.08 mm.

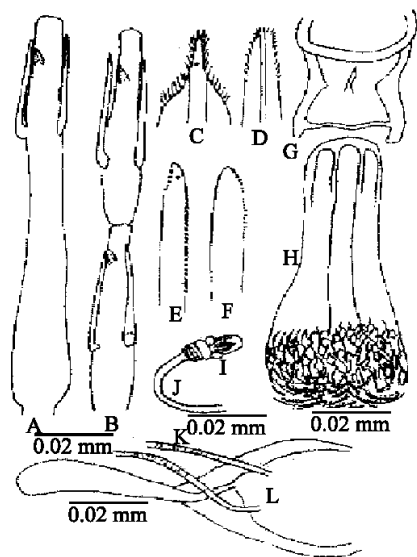


Fig. 3: Camera Lucida drawings of *Phlebotomus (Phlebotomus)* Sp. [C] (1♀) from Parom showing: the third (A), fourth (B, lower) and the fifth (B, upper) antennal segments hypopharynx (D), labrum (C), maxilla (E), mandible (F), cibarium (G), pharynx (H) spermatheca (I), ducts (J), distal part ducts with weak striations (K), genital atrium (L)

6. Ascoid 4/ A4 in *Ph. papatasi* (0.0272), *Ph. bergeroti* (0.62), *Ph. salehi* (0.21.4) but in the specimen B (0.38).
7. Cibarial armature I n *Ph. papatasi*, *Ph. bergeroti*, *Ph. salehi* (spicules and denticles present) but in the specimen B, spicules and denticles absent.
8. The morphology of spermatheca of specimen B is quite different as it is relatively longer in length and proximal segments are comparatively broader as compared with that of *Ph. bergeroti* whereas the shape of this structure is quite distinguishing in *Ph. papatasi* and *Ph. salehi*.

The above mentioned differences in characters separate the undetermined specimen from the already described species of the subgenus. Accordingly it is regarded as an undetermined Sp. [B].

***Phlebotomus (Phlebotomus)* Sp. [C]:** Wing 1.72 mm long, 0.056 mm broad, =0.36 mm, =0.24 mm long, =0.096 mm, =0.36 mm, =0.056 mm, alar index=1.5. Palp formula 1, 4, 2, 3 and palp ratio 1:3.25:4:2.75. Antenna 3 (Fig. 3A) 0.24 mm long, ascoid 0.062 mm long, position of ascoid on A3=0.708, ascoid 3/A3=0.258, position of a single papilla on A3= 0.875. A4 (Fig. 3B, lower) 0.11 mm long, ascoid on A4 =0.064 mm long, position of ascoid on A4=0.272, ascoid 4/A4=0.581, position of a papilla on A4=0.818. A5

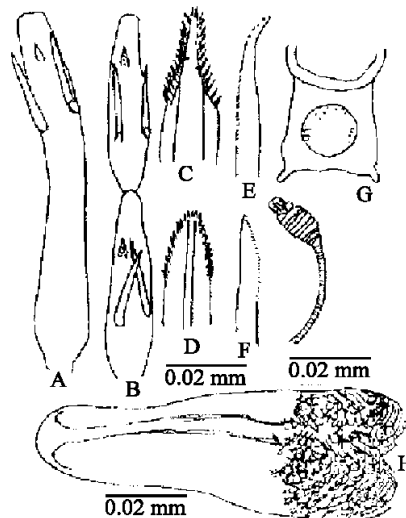


Fig. 4: Camera Lucida drawings of *Phlebotomus (Phlebotomus)* Sp. [D] (1♀) from M and showing: the third (A) fourth (B, lower) and the fifth (B, upper) antennal segments, hypopharynx (D), labrum (C), maxilla (E), mandible (F), cibarium (G), pharynx (H), spermatheca (I)

(Fig. 3B, upper) 0.114 mm long, ascoid 5=0.064 mm long, mm, =0.36 mm, =0.056 mm, alar index=1.5. Palp formula 1,4,2,3 and palp ratio 1:3.25:4:2.75. Antenna 3 (Fig. 3A) 0.24 mm long, ascoid 0.062 mm long, position of ascoid on A3=0.708, ascoid 3/A3=0.258, position of a single papilla on A3= 0.875. A4 (Fig. 3B, lower) 0.11 mm long, ascoid on A4 =0.064 mm long, position of ascoid on A4=0.272, ascoid 4/A4=0.581, position of a papilla on A4=0.818. A5 (Fig. 3B, upper) 0.114 mm long, ascoid 5=0.064 mm long, position of ascoid on A5=0.228, ascoid 5/A5=0.561, position of papilla on A5=0.789. There are two ascoids at segments III to XV. A3/Labrum=0.96, A3/A4+5=1.07. Labrum (Fig. 3C) 0.25 mm long, 0.03 mm broad and a dental depth of 0.046 mm. Hypopharynx (Fig. 3D) with a dental depth of 0.038 mm. Maxilla (Fig. 3E) with seven lateral (four large teeth and three smaller) and 19 ventrals and a dental depth of 0.08 mm. Mandible (Fig. 3F) 0.014 mm broad, seven re-curved teeth per 0.01 mm and a dental depth of 0.044 mm. Cibarium (Fig. 3G) 0.05 mm broad, chitinous arch developed, cibarium with a few short lateral spicules and scattered denticles. Pharynx (Fig. 3H) is about 2.3 times as long as broad and its widest posterior portion was not quite twice as wide as the narrowest anterior part. There is no marked posterior dilation of this structure. The pharyngeal armature is well developed and consists of a series of long later o-posteriorly directed spines. The spines at the anter o-median part are much

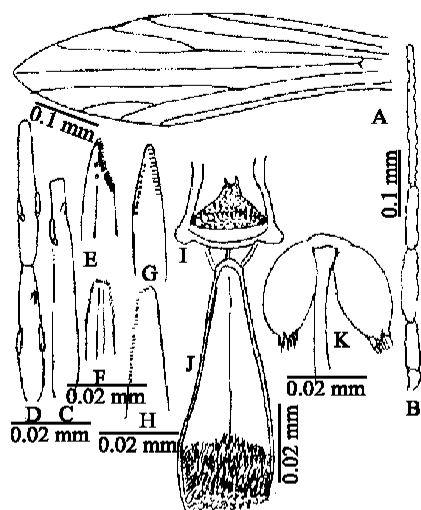


Fig. 5: Camera Lucida drawings of ♀ *Sergentomyia* (*Parrotomyia*) Sp. [A] from Turbat showing: wing (A), palps (B), the third (C), the fourth (D, lower), and fifth (D, upper) antennal segments, labrum (E), hypopharynx (F), maxilla (G), mandible (H), cibarium (I), pharynx (J), spermatheca (K)

stouter and placed very close together, whereas those of the posterior basal ones were slender, widely scattered and transverse lines with punctiform denticles. The armature occupies 0.28 of the length of pharynx. Spermatheca (Fig. 3I) 5-6 segmented, the first proximal segment is two times larger while the distal ones markedly thinner. The proximal part of the duct is without transverse striations (Fig. 3J), but most distal part of duct has faint and weak transverse striations (Fig. 3K), ducts have separate openings into the genital atrium (Fig. 3L).

**Male:** Not came in present collection.

**Type locality:** A single ♀ sandfly was caught on 05-01-2001 through sticky traps from Govt. High School Teacher's quarter at Parom (near Pak Iran border, 60 miles away from Panjgour towards west).

**Remarks:** This specimen is comparable with other species of the subgenus *Phlebotomus*. The following character separate this specimen C from other known species:

1. A3/labrum ratio in *Ph. papatasi* is 0.88, in *Ph. bergeroti* 0.84, in *Ph. salehi* 0.7 but in the specimen C (0.96) it is quite high.

2. Dental depth of maxilla in *Ph. papatasi* is 0.108 mm, in *Ph. bergeroti* 0.1 mm, in *Ph. salehi* 0.098 mm, but in the specimen C (0.08 mm) dental depth is quite shorter.
3. Dental depth of Hypopharynx in *Ph. papatasi* 0.056 mm, in *Ph. bergeroti* 0.04 mm, in *Ph. salehi* 0.028 mm but in the specimen C (0.038 mm).
4. Pharynx length / breadth ratio is high in *Ph. papatasi* (2.48-3.33), in *Ph. bergeroti* 2.82-2.95, in *Ph. salehi* 2.61-2.64, but in specimen C (2.3) it is quite low.
5. The spicules and denticles are lacking in the cibarium of specimen C whereas these structures are present in *Ph. papatasi*, *Ph. bergeroti* and *Ph. salehi*.
6. The morphology of spermatheca of the specimen C is quite interesting as its proximal segment is two time large as compared with distal segments which are very thin. It is comparable with the spermatheca of *Ph. papatasi*, *Ph. bergeroti* and *Ph. salehi*.

The above mentioned differences in character separates the specimen C with other already known species of the genus *Phlebotomus*. Accordingly it is named as undetermined Sp. [C].

***Phlebotomus* (*Phlebotomus*) Sp. [D]:** Wing 1.68 mm long, 0.48 mm broad, =0.32 mm, =0.32 mm, =0.08 mm, =0.28 mm, =0.096, alar index 1.33. Palp formula 1, 4, 2, 3, palpal ratio 1: 3.25: 4: 3. Antenna 3 (Fig. 4 A) 0.18 mm long, ascoid of A3 0.046 mm long, position of ascoid on A3=0.61, ascoid 3/A3=0.255, position of a single papilla on A3=0.83. A4 (Fig. 4B, lower) 0.094 mm long, ascoid of A4=0.036 mm long, position of ascoid on A4=0.319, ascoid 4/A4=0.382, position of a single papilla on A4=0.74. A5 (Fig. 4B, upper) 0.092 mm long. Ascoid of A5=0.04 mm long, position of ascoid on A5=0.326, ascoid 5/A5=0.434, position of a single papilla on A5=0.76. There are two ascoids on segments III to XV. A3/labrum=0.918, A3/A4+5=0.967. Labrum (Fig. 4C) 0.29 mm long, 0.032 mm broad, with 2 sharp apical sensilla and a sensilla depth 0.05 mm. Hypopharynx (Fig. 4D) 0.022 mm broad, apex pointed and a dental depth 0.04 mm. Maxilla (Fig. 4E) 0.012 mm broad with four lateral and 17 ventral teeth and a dental depth 0.08 mm. Mandible (Fig. 4F) 0.012 mm broad, with six re curved teeth per 0.01 mm and a dental depth 0.048 mm. Cibarium (Fig. 4G) 0.05 mm broad. Chitinous arch developed, a few spicules and denticles present but not in a definite row. Pharynx (Fig. 4H) 0.19 mm long, the widest posterior portion being 1.8 times as broad as the narrow anterior part, the length was nearly 2.69 times the greatest breadth. The Armature consists of very numerous fine teeth and few lateral teeth directed towards the center. The basal armature is composed of

Table 1: Comparison of taxonomic characters (in mm) of ♀ *Phlebotomus* (*Phlebotomus*) Sp.[A], Sp. [B], Sp.[C], Sp.[D] collected from Balochistan and data of ♀ *P. papatasi*, *P. bergeroti* and *P. salehi*<sup>[12]</sup>

Taxonomic characters									
♀	Alar index	Length of ascoïd of A3	Ascoïd 3/A3	A3/A4+5	A3/labrum	Ascoïd 4/A4	Pharynx length /breadth	Height of pharyngeal armature/length of pharynx	Anterior breadth of pharynx/posteriorbreadth
<i>P. papatasi</i>	1.39-1.60	0.040-0.05	0.187	1.14	0.880	0.272	2.48-3.33	0.244-0.290	2.00-2.25
<i>P. bergeroti</i>	1.50-1.75	0.064	0.290	1.04-1.128	0.846	0.620	2.82-2.95	0.263-0.269	2.20-2.35
<i>P. salehi</i>	1.56-1.60	0.040-0.05	0.214	1.00	0.700	0.459	2.61-2.64	0.277-0.318	1.70-1.82
Sp. [A]	1.83	0.060	0.285	0.92	0.770	0.584	3.28	0.300	1.75
Sp. [B]	1.16	0.060	0.200	0.75	0.750	0.380	3.00	0.330	1.57
Sp. [C]	1.50	0.062	0.258	1.07	0.960	0.581	2.30	0.280	2.00
Sp. [D]	1.33	0.046	0.255	0.967	0.918	0.382	2.69	0.315	1.80

irregular transverse ridges with punctiform denticles. Armature occupies about 0.315 times the length of pharynx. Spermatheca (Fig. 4I) with narrow head, 7-8 segmented, segments relatively narrow and less decrease towards duct, ducts long with transverse striations.

**Male:** Not came in present collection.

**Type locality:** A single ♀ sandfly was found on 09-1-2001 by the author on the mud wall of human residence at Mand (near Pak-Iran border, Makran).

**Remarks:** This specimen D is comparable with other closest allies of the subgenus *Phlebotomus*. The following characters separate these specimen D from other known species:

1. Number of maxillary teeth and dental depth of maxilla in *Ph. papatasi* (7 dot like lateral teeth -6 more prominent and one is weakened 19 ventral teeth and a dental depth of 0.108 mm), *Ph. bergeroti* (6 lateral-3 strong and 3 weak, 20 ventral teeth and a dental depth of 0.1 mm), *Ph. salehi* (11 lateral and 23 ventral teeth and a dental depth of 0.098 mm) but 4 lateral and 17 ventral teeth and a dental depth of 0.08 mm in the specimen D.
2. Number of mandibular teeth and dental depth of mandible in *Ph. papatasi* (7 small recurved teeth per 0.01 mm and a dental depth of 0.06 mm), *Ph. bergeroti* (4 strongly recurved teeth per 0.004 mm and a dental depth of 0.042 mm), *Ph. salehi* (31 small recurved teeth and a dental depth of 0.04 mm) but 6 recurved teeth per 0.01 mm and a dental depth of 0.048 mm in the specimen D.
3. Spermatheca of specimen D is broader but not longer as compared with that of *Ph. bergeroti* (spermatheca is less broader but longer). Shape of this structure is markedly different in *Ph. papatasi* and *Ph. salehi*.

The above mentioned differences in characters of specimen D separates it with other known species of the subgenus *Phlebotomus*. Accordingly, it is named as undetermined Sp. [D].

Comparison of taxonomic characters of these four undetermined species with their closest allies viz., *Ph. papatasi*, *Ph. bergeroti*, *Ph. salehi*<sup>[12]</sup> (Table 1).

Two ♀ sandflies were also caught and their taxonomic position is as under:

#### Taxonomic affinity

**Genus:** These 2 flies have cibarium with a transverse row of teeth, fore teeth also present, broad bifid pigment patch present, hind ends of abdominal tergites usually with recumbent hairs<sup>[7,9]</sup>. These characters place the present flies in the genus *Sergentomyia*.

**Subgenus:** A comb like cibarial armature, lamp-glass shaped pharynx and spermatheca in the form of spherical capsule<sup>[7,9]</sup>. These characters place the present flies in the subgenus *Parratomyia* Theodoer<sup>[13]</sup>.

***Sergentomyia* (*Parratomyia*) Sp. [A]:** Female (2 specimens examined) wing (Fig. 5A), 1.2 mm long, 0.28 mm broad, =0.12 mm, =0.24 mm, =zero, =0.24 mm, =0.096 mm. Palp (Fig. 5B) 0.466 mm long, palp ratio 1, 3.3, 5, 4.5, 9.5, palp formula, 1, 2, 4, 3, 5. A3 (Fig. 5C) 0.13 mm long, ascoïd 0.016 mm long, position of ascoïd on A3=0.76, ascoïd 3/A3=0.123, position of a single papilla on A3=0.92, A3/labrum=1.0, A3/A4+5=0.849. A4 (Fig. 5D, lower) 0.076 mm long, ascoïd on A4=0.016 mm, position of ascoïd on A4=0.31, ascoïd 4/A4=0.21, position of a papilla on A4=0.73. A5 (Fig. 5D, upper) 0.077 mm long, ascoïd on A5=0.016 mm long, position of ascoïd on A5=0.257, ascoïd 5 /A5=0.206. Labrum (Fig. 5E) 0.13 mm long, 0.017 mm broad and a sensilla depth of 0.028 mm. Hypopharynx (Fig. 5F) apex broad and a dental depth of 0.026 mm. Maxilla (Fig. 5G) broad (0.012 mm) with 12 lateral and about 10 ventral teeth, a dental depth of 0.016 mm. Mandible (Fig. 5H) broad (0.019 mm), 5 weak teeth per 0.004 mm, a dental depth of 0.032 mm. Cibarium (Fig. 5I) 0.06 mm broad, with 19-22, uniform parallel, arrow like teeth on an almost straight line, about 17-20 dot like minute punctiform denticles at the base of teeth,

Table 1: (continued)

Taxonomic character						
♀	Pharyngeal Armature	Morphology of labrum	Morphology of hypopharynx	Maxilla	Mandible	Spermatheca
<i>P. papatasi</i>	More developed but not pointing backward	2 blade like stout apical sensilla, sensilla depth = 0.048 mm	Apex pointed with 2 apical and about 16 teeth on each side, dental depth=0.056 mm.	Narrow, 0.012 mm broad, 19 ventral teeth, dental depth=0.108	Narrow, 0.014 mm broad with 7 small fine re-curved teeth per 0.01 mm, dental depth of 0.06 mm.	Cylindrical, larger (less difference in proximal and distal segments)
<i>P. bergeroti</i>	Central part blunt more pigmented and arranged obliquely and pointing backward	2 short apical blade like hairs, sensilla depth = 0.052 mm	3 apical pointed teeth and about 18 strongly undulating lateral teeth, dental depth 0.04 mm	Narrow, 0.009 mm broad with six (3 prominent and 3 weak) lateral teeth and about 20 ventral teeth, dental depth=0.1	Slender, 0.01 mm broad with 4 strongly re-curved teeth per 0.01 mm, dental depth of 0.042 mm	Cylindrical, shorter (no markedly difference in proximal and distal segments)
<i>P. salehi</i>	Anterior armature composed of triangular or quadrate scales	2 short apical sensilla, sensilla depth = 0.046 mm	About 0.028 mm broad, 3-4 short apical teeth and about 13 relatively long lateral teeth, dental depth = 0.028 mm	0.016 mm broad with eleven lateral and about 23 ventral teeth, dental depth=0.098	With blunt tip, fore width 0.008 mm, median width 0.026 mm, about 31 small re-curved teeth and a dental depth of 6 teeth per 0.01 mm.	Spermatheca narrowing towards the base (proximal segments broader and more distal ones are shorter)
Sp. [A]	The foremost and basal armature consists of short ridges with punctiform small teeth whereas the median part armed with numerous less broad scales like teeth	0.032 mm broad and a sensilla depth =0.056 mm	0.021 mm broad, dental depth of 0.048 mm	With 9 lateral teeth (3 larger and six smaller) and 24 ventrals, dental depth=0.096	0.02 mm broad with 3 teeth per 0.004 mm and a dental depth of 0.052 mm.	Very short, segments short and narrow, compacted, ducts long and transversely striated, ducts with separate openings.
Sp. [B]	Two group of teeth: long triangular teeth in foremost two thirds and ridges of denticulations in centro-posterior part.	0.032 mm broad and a sensilla depth = 0.048 mm	With a dental depth of 0.042 mm	With 8 lateral teeth (3 bigger and 5 smaller) and 17 ventrals, Dental depth=0.08	0.016 mm broad with 7 teeth per 0.01 mm and a dental depth 0.052 mm.	5-6 segmented, collar thin, 1st proximal segment is narrowest, 2nd and 3rd, relatively broader and larger, remaining 3 or 4 are of equal length but narrower, last distal segment is quite smaller, ducts longer with transverse striations, ducts with separate opening.
Sp. [C]	Well developed, a series of long latero posteriorly directed spines, spines at antero median part are much stout and compact whereas the postero-basal ones are slender, widely scattered transverse lines with punctiform denticles.	0.03 mm broad, sensilla depth = 0.046 mm	With a dental depth of 0.038 mm	With 7 lateral (4 larger teeth and 3 smaller) and 19 ventrals, dental depth=0.08	0.014 mm broad with 7 re-curved teeth per 0.01 mm, dental depth of 0.044 mm.	5-6 segmented, proximal segments relatively larger whereas the distal ones markedly decrease towards the ducts, proximal part of duct without striations but more distal part with faint and weak transverse striations, ducts have separate openings.
Sp. [D]	Very numerous fine teeth and few lateral teeth directed towards the centre.	2 sharp apical sensilla, sensilla depth = 0.05 mm	0.022 mm broad, apex pointed, dental depth = 0.04 mm	0.012 mm broad with 4 lateral and 17 ventral teeth and a dental depth of 0.08 mm	0.012 mm broad with 6 re-curved teeth per 0.01 mm, dental depth of 0.048 mm.	With narrow head, 7-8 segmented. Segments relatively narrow and less decrease towards the duct, ducts long with transverse striations.

Table 2: Comparison of taxonomic characters ( in mm) of ♀ *Sergentomyia (Parrotomyia)* Sp. [A] from Balochistan and published data of related species of the subgenus *Parrotomyia* from neighboring territories

♀ Taxonomic characters	Balochistan (Present study)	<i>S. grekovi</i> (Khodukin) from Central Asia <sup>[10]</sup>	<i>S. grekovi</i> (Khodukin) from Balochistan <sup>[12]</sup>	<i>S. sogdiana</i> (Parrot) from Central Asia <sup>[10]</sup>	<i>S. sumbarica</i> (Perfiliev) from Central Asia <sup>[10]</sup>
Wing Length	1. 2		Wing missing		
Palp formula	1, 2, 4, 3, 5.	1, 2, 3-4, 5	1, 2, 4, 3, 5	1, 2, 3-4,5 or 1,2, 3,4, 5	1,2,4,3,5 or 1,2,3-4,5
A3 Length	0.13	0.20-0.23	0.13	0.12-0.15	0.14-0.16
A3/A4+5	A3<A4+5	A3<A4+5.	A3<A4+5	A3>A4+5	A3<A4+5
Labrum Length	0.13				
Ascoid 4/A4	Short, 0.21	1/3	0.55-0.611 (ascoids long)	1/3	Ascoids short.
Cibarium	19-22, uniform, parallel, arrow like long teeth on an almost straight line, minute punctiform denticles at the base of teeth, a large triangular pigmented area with apex bifid and base almost straight, postero lateral edges of cibarium knob like.	20, 30, 35 cibarial teeth with long points on a line slightly convex anteriorly, minute denticles at the base of teeth, pigment patch large, with square anterior process.	About 11 long , parallel teeth on an almost straight line, minute denticles at the base of teeth, pigmented patch large with short conical anterior process, postero lateral edges of cibarium knob like.	30-35 uniform, arrow like narrow teeth with short points on a straight line, a row of fine point like teeth anterior to buccal teeth, pigmented area large, triangular, its apex in the form of alighter square process.	12-17 large uniform, parallel teeth with long points, minute triangular denticles at base of buccal teeth, pigmented area large, more or less triangular, apex conical.
Pharynx	Armature well developed and consists of long spines.	Armature little developed, consisting of irregular spines, oblique lines are present at the sides of armature.	Armature consists of weak and short transverse lines.	Spines well marked, pointed and of uniform size.	Pharynx with weakly developed armature.
Spermatheca	Relatively large, almost twice as long as broad (about 0.052 long, 0.027 broad, apical cap prominent, individual ducts short and open into a common duct.	More or less oval form.	Small (0.008 mm long, 0.006 mm broad, almost oval.	Spermatheca with large sub globular capsule	Spermatheca with large, broad, oval capsule and narrow ducts.

Table 2: (continued)

♀ Taxonomic characters	<i>S. palestinensis</i> (Adler and Theodor) from Central Asia <sup>[10]</sup>	<i>S. palestinensis</i> (Adler and Theodor) from Peshawar, Pakistan <sup>[8]</sup>	<i>S. palestinensis</i> <sup>[13]</sup> from Jericho, Palestine.	<i>S. palestinensis</i> (Adler and Theodor) from Balochistan <sup>[12]</sup>
Wing Length		-	-	-
Palp formula	1, 2, 3-4, 5	-	1, 2, 3-4, 5	1, 2, 3, 4, 5.
A3 Length				
A3/A4+5	0.17-0.19			
A3<A4+5	-	-	0.13-0.14	
A3<A4+5				
Labrum Length	0.14	0.14 mm long, labrum is broad	-	0.12
Ascoid 4 /A4	¼	-	-	0.20-0.22
Cibarium	20-22 uniform teeth with long points on a straight line or on a line slightly convex anteriorly, an anterior row of very small punctiform denticles at base of buccal teeth, pigmented area broad more or less triangular, apex conical	16 teeth, each with a nodular thickening, the chitinous arch and postero lateral edges of cibarium are prominent.	20 teeth, stand on a straight line, they are parallel and pointed posteriorly, pigmented area is roughly heart shaped, the apex anterior.	15-18 parallel arrow like teeth on a straight line, punctiform denticles at the base of teeth, pigmented area large, apex conical and with bifid short anterior process, postero lateral edges of cibarium knob like.
Pharynx	Armature well developed, spines of armature pointed.	-	The widest part posteriorly is twice as wide as the anterior part and teeth are very numerous, strongly marked. The posterior margin of the toothed area is slightly indented.	The widest part posteriorly is 2.25-2.27 times as wide as the anterior shortest breadth, armature well developed and consists of large teeth anteriorly and smaller vertical ridges posteriorly.
Spermatheca	With globular capsule but short narrow partly fused duct.	-	Almost spherical, length to breadth 4: 3	Almost rounded.

pigmented area large, triangular, about 0.034 mm long and 0.028 mm broad, base of pigment patch almost straight, but apex bifid. Pharynx (Fig. 5J) 0.14-0.15 mm long and is stout in character and not so markedly dilated posteriorly as in some other species, its greatest breadth posteriorly was about 1.83-1.86 times of the narrower anterior portion and its length was about 2.27-2.50 times its greatest breadth. Anterior edge of the armature is convex semicircular and straight posterior margin. The anterior and median pharyngeal armature well developed and consists of well marked and packed long spines and oblique lines are present at and packed long spines and oblique lines are present at the sides of the wall of pharynx. The posterior armature is short dot like but developed. Armature occupies 0.28-0.29 of the pharynx. Spermatheca (Fig. 5K) with relatively large broad capsule, almost twice as long as broad, (about 0.052 mm long, 0.027 mm broad), the apical cap was very prominent (0.014 mm long and 0.009 mm deep), individual duct short and open into a common duct.

**Male:** Not came in present collection.

**Type locality:** Two ♀ sandflies were collected by the author on 11.1.2001 and 01.02. 2001 from the mud walls of human residences through sticky traps in Turbat and Bela, respectively.

**Remarks:** This specimen A is comparable with its closest allies of the sub genus *Parratomyia*. The following differences in characters separate this specimen from known species of the subgenus *Parratomyia*.

1. 19-22, uniform, parallel arrow like cibarial teeth on an almost straight line and minute punctiform denticles at the base of these teeth in specimen A whereas in *S. grekovi* Khodukin<sup>[14]</sup> 18-30 and 18-35 cibarial teeth<sup>[7,9]</sup>, in *S. palestinensis* Adler and Theodor<sup>[15]</sup> 20-24, 15-22 cibarial teeth<sup>[7,9]</sup>, in *S. sogdiana* 30-38 cibarial teeth<sup>[7]</sup>, in *S. sumbarica* Perfiliev<sup>[16]</sup> 1-17 teeth with long points<sup>[7]</sup>, *S. africana magna* Sinton<sup>[17]</sup> 45-50 teeth in a concave row<sup>[9]</sup>, *S. babu babu* Annandale<sup>[18]</sup> 24-34 teeth<sup>[9]</sup>, *S. baghdadis* Adler and Theodor<sup>[19]</sup> 16-20 teeth<sup>[9]</sup>, *S. himalayensis* Annandale<sup>[18]</sup> 80-100 cibarial teeth<sup>[9]</sup>, *S. kauli* Lewis<sup>[9]</sup> 26-32 cibarial teeth<sup>[9]</sup>.
2. Spermatheca large (0.052 mm) almost twice as long as broad, apical cap prominent in Sp.[A] whereas in *S. grekovi* rounded<sup>[7]</sup>, in *S. sumbarica* with oval capsule<sup>[10]</sup> and *S. palestinensis* almost rounded<sup>[7]</sup>.

The above mentioned differences in characters separates the Sp. [A] with known species of the subgenus *Parratomyia*. Accordingly it is named as Sp. [A]. Its taxonomic characters are compared with the published data of related species of the subgenus *Parratomyia* from Balochistan (Pakistan)<sup>[20]</sup> and from neighboring countries (Table 2).

While describing Phlebotomine sandflies of Pakistan, Lewis<sup>[8]</sup> recorded *Phlebotomus (Larroussius)* Sp. [A] (the only available ♀ specimen from Saidpur) and *Sergentomyia (Parratomyia)* Sp. [B] (the single ♀ specimen from Bahadur near Peshawar), therefore, the possibility exists of new species or variety from Pakistan. It is hoped that further studies will throw light on the composition of the fauna of phlebotomine sandflies of Pakistan. Until, this is done, the results of the present study would provide useful information for future workers.

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