



# Journal of Biological Sciences

ISSN 1727-3048

**science**  
alert

**ANSI***net*  
an open access publisher  
<http://ansinet.com>

## Analysis of Diagnostic Parameters of the Pakistani Species of the Subgenus *Sergentomyia* (Diptera, Psychodidae)

Juma-Khan Kakarsulemankhel  
 Sandflies, Leishmaniasis and Mosquitoes Laboratory/Zoology, University of Balochistan,  
 Sariab Road, Quetta-87300, Pakistan

**Abstract:** During an extensive taxonomic study conducted in the whole of the Balochistan Province in 1996-2001, six species of the genus *Sergentomyia* subgenus *Sergentomyia* were collected. Detailed analysis of their diagnostic characters is given in the present paper to facilitate their identification.

**Key words:** Sandfly, subgenus *Sergentomyia*

### INTRODUCTION

Lewis<sup>[1]</sup> classical work was based on the sandflies of Punjab, N. W. F. P. and Sindh Provinces, but Balochistan Province, the biggest one of the country, was left un-surveyed. In view of the insufficient work of Lewis<sup>[1]</sup>, the present survey was conducted in the whole of the Balochistan Province (1996-2001) to study the fauna of the sandflies. Comparison of diagnostic parameters of the six species of the subgenus *Sergentomyia* viz., *Sergentomyia fallax* Parrot<sup>[2]</sup>, *S. punjabiensis* Sinton<sup>[3]</sup>, *S. murghabiensis* Perfiliev<sup>[4]</sup>, *S. mervynae* Pringle<sup>[5]</sup>, *S. dentate arpaklensis* Perfiliev<sup>[6]</sup> and *S. theodori pashtunica* Artemiev<sup>[7]</sup> are presented here.

### MATERIALS AND METHODS

Sandflies were collected from in-doors as well as from out doors using suction tubes, sticky paper and light traps. Flies were processed, preserved, dissected and

mounted according to the conventional methods especially those adopted by Johnson *et al.*<sup>[8]</sup>, Lewis<sup>[9]</sup>, Killick-Kendrick<sup>[10]</sup> and Killick-Kendrick *et al.*<sup>[11]</sup>. For species identification, keys furnished by Lewis<sup>[1,12,13]</sup> and Artemiev<sup>[14]</sup> were consulted. Specimens are housed with the author's collection of Sandflies, Department of Zoology, University of Balochistan, Quetta.

### RESULTS AND DISCUSSION

Fifty-eight parameters of the male and 47 characters of female specimens were studied, compared and presented in the given Table 1 and 2.

In male, wings and alar index of *S. t. pashtunica* were observed to be larger whereas of *S. punjabiensis* were found of smaller. Similarly, A3 of *S. t. pashtunica* were found to be larger while of *S. murghabiensis* were observed to be shorter. A 3/labrum of *S. murghabiensis* and *S. pashtunica* were found larger as compared with the shortest of *S. punjabiensis*. Ascoid/A3 of *S. mervynae*

Table 1: Comparison of diagnostic characters and morphometrics (mm) of the species of subgenus *Sergentomyia* (Male)

Key parameters	<i>S. fallax</i>	<i>S. punjabiensis</i>	<i>S. murghabiensis</i>	<i>S. mervynae</i>	<i>S. d. arpaklensis</i>	<i>S. t. pashtunica</i>
Head length	-----	-----	0.29	-----	-----	-----
x wing length			0.28			
Breadth			0.30			
Eye length			0.15			
x head length			0.51			
Breadth			0.08			
Distance between eyes			0.12			
Wing length	0.09-1.28	0.96-1.04	1.04-1.10	1.04-1.12	wings damaged	1.28-1.36
Breadth	0.19-0.27	0.22-0.24	0.20-0.22	0.26-0.28		0.26-0.28
$\alpha$	0.08-0.11	0.08-0.09	0.06-0.08	0.06-0.12		0.12-0.14
$\beta$	0.16-0.20	0.20-0.24	0.18-0.20	0.18-0.23		0.20-0.23
$\delta$	zero-0.03	zero-0.03	0.02-0.04	zero		0.04-0.05
$\gamma$	0.20-0.02	0.20-0.24	0.25-0.28	0.20-0.23		0.28-0.30
$\pi$	zero-+0.04	0.06-0.10	0.03-0.04	0.04		0.08-0.09

**Corresponding Author:** Dr. Juma-Khan Kakarsulemankhel, Head, Sandflies, Leishmaniasis and Mosquitoes Laboratory/Zoology, University of Balochistan, Sariab Road, Quetta-87300, Pakistan Fax: ++ 92-81-9211277  
 E-mail: jumakhankakar@yahoo.co.uk

Table 1: Continue

Key parameters	<i>S. fallax</i>	<i>S. punjabiensis</i>	<i>S. murghabiensis</i>	<i>S. mervynae</i>	<i>S. d. arpakensis</i>	<i>S. t. pashunica</i>
Alar index	0.50-0.56	0.40	0.37-0.40	0.51-0.52		0.08-0.09
Palp length	0.50	0.49	0.44	0.42-0.46	0.45	0.45-0.54
Anteuna 3	0.10-0.11	0.08	0.11-0.12	0.09-0.10	0.11	0.11-0.12
X wing length	1.08-0.09	0.07-0.08	-----	-----	--	---
X labrum length	1.04-1.05	0.71	1.00-1.10	0.90-0.91	0.94	1.09-1.10
X A4+A5	0.72-0.80	0.78-0.80	0.74-0.75	0.77-0.83	0.73	0.75
Ascoid length	0.01-0.01	0.01	0.01-0.02	0.01	0.01	0.01-0.18
Ascoid/A3	0.13-0.13	0.12	0.16-0.16	0.20	0.14	0.14-0.15
Anteuna 4	0.06-0.08	0.05-0.05	0.07-0.08	0.05-0.06	0.07	0.07-0.08
Ascoid length	0.01-0.01	0.01	0.18-0.02	0.02	0.01	0.01-0.01
Ascoid/A4	0.26-0.22	0.26-0.28	0.25	0.33-0.35	0.21	0.22-0.22
Anteuna 5	0.07-0.08	0.05	0.07-0.08	0.06	0.07	0.76-0.08
Ascoid length	0.01-0.02	0.01	0.01-0.02	0.01	0.01	0.01-0.01
Ascoid/A5	0.25	0.27	0.25	0.30	0.21	0.21-0.22
Single ascoid and its position						
on A3,	0.59	0.67	0.63-0.66	0.65	0.63	0.61
on A4,	0.22-0.26	0.36	0.25-0.28	0.38	0.26	0.28
on A5,	0.24	0.38	0.23-0.24	0.37	0.27	0.25
Single papilla and its position						
on A3,	0.79	0.65	0.81-0.83	0.82	0.81	0.76
on A4,	0.70	0.69	0.65-0.87	0.78	0.65	0.67
Proboscis length	----	---	0.14	-----	----	0.13-0.14
Labrum length	0.10-0.11	0.11	0.10-0.12	0.10-0.11	0.11	0.10-0.11
Sensilla depth	0.02	0.03	0.03	0.03	0.03	0.02
Hypopharynx	apex pointed	apex pointed	apex pointed	apex pointed	apex pointed	apex pointed
Breadth	0.01	0.01	0.01	0.01	0.01	0.01
Dental depth	0.02	0.03	0.02	0.02	0.03	0.02
Maxilla	---	---	smooth	---	smooth	----
Cibarium breadth	0.04-0.46, with 20 small uniform teeth on a concave row,	0.04, with 18 uniform small teeth and a few dot-like denticles at bases	0.040-0.04, with 11-15 uniform small teeth, central teeth shorter than laterals	0.04-0.05 with 15-18 weak blunt teeth with a few dot like minute denticles at the base of teeth	0.04, with 16 small pointed teeth of equal size shorter than laterals	0.04-0.04 with 14-16 teeth, central teeth
Pigment patch	rounded	triangular	absent	oval shaped	oval shaped	absent
Anterior process	invisible	absent	absent	absent	absent	absent
Pharynx length	0.10-0.12	flask shaped, 0.12	0.11-0.12	0.12	0.11-0.12	0.11-0.12
Length/breadth	2.85	2.40-2.60	3.15	2.50-2.70	3.33	3.28
Anterior part/						
Posterior part	1.23-1.40	1.64-1.66	1.46	2.00	1.28	1.45
Posterior	no	present	no	no	no	no
Dilation						
Armature	weak armature	a series of weak, faint, short, straight and curved spines parts slender and weak while centrals are stout	weak, transverse lines, spines of lateral and posterior	short serrated ridges	well developed, with series of short spines	weak transverse rows
Armature occupies	---	---		0.25-0.30	0.16	---
Coxite length	0.18-0.23	0.19-0.20	0.20-0.21	0.20-0.21	0.21	0.21-0.22
Breadth	0.06-0.07	0.06-0.07	0.06-0.06	0.08	0.06	0.06-0.06
Coxite/A3	1.73-1.98	2.37-2.50	1.75-1.81	2.10-2.22	1.91	1.90-2.00
Coxite/labrum	1.80-2.09	1.69-1.78	1.75-2.0	1.90-2.00	1.81	2.00-2.10
Coxite/style	2.55-2.57	2.50-2.71	2.25-2.5	2.63-2.76	2.62	2.62-2.75
Style length	0.07-0.09	0.07-0.08, with 4 apical spines as long as style or longer	0.08, 2 apical and 2 sub apical spines, spines longer than style	0.07, with 4 terminal spines	0.08, with 2 apical and 2 sub apical spines	0.08, with 4 terminal spines, longer than styles
Breadth	0.02	---	0.02-0.24	0.03	0.02	0.02
A ventral seta at	0.88	0.75	0.80	0.86	0.87 (near sub-apical spine)	0.90
Paramere length	0.12-0.13, apex rounded or blunt	0.11, with with beaked ends	0.12-0.13, with rounded ends	0.11-0.12	0.12, with blunt rounded ends	0.12, with rounded ends
Aedeagus length	0.08-0.09 x	0.07, x	0.08-0.09, with a slight apical with notch at 0.95, base not bulbous	0.07-0.09, apointed sub apical notch at 0.88	0.08	0.08-0.10, with a sub apical tubercle at 0.96

Table 1: Continue

Key parameters	<i>S. fallax</i>	<i>S. punjabiensis</i>	<i>S. murghabiensis</i>	<i>S. mervynae</i>	<i>S. d. carpaktensis</i>	<i>S. t. pashtunica</i>
Breadth	0.01-0.01	very thick with with broad base (0.03)	0.014	0.01-0.01	0.01	0.02
Filament/ Pump	smooth 3.55-3.57	smooth 3.0-3.25	---- 2.25-3.25	---- 3.71-3.75	--- 3.25	smooth 3.33-4.00
Surstyle/coxite	0.73-0.88	0.79-0.80	0.80-0.85	0.80-0.85	0.85	0.80-0.88

Table 2: Comparison of diagnostic characters and morphometrics (mm) of the species of subgenus *Sergentomyia* (Female)

Key parameters	<i>S. fallax</i>	<i>S. punjabiensis</i>	<i>S. murghabiensis</i>	<i>S. mervynae</i>	<i>S. d. carpaktensis</i>	<i>S. t. pashtunica</i>
Head length	0.26-0.28	0.33	0.27-0.28	----	-----	0.28-0.29
Breadth	0.24-0.25	0.36	0.25-0.28			0.25-0.27
X wing length	0.20-0.21	-----	-----			
Eyes length	0.09-0.10	0.13-0.17	0.14-0.16			0.14-0.15
Distance between eyes	0.12-0.14	0.16	0.07-0.08			0.09-0.10
Wing length	1.28-1.30	1.12	1.28-1.30	1.20-1.30	1.28	1.20-1.30
Breadth	0.30-0.32	0.25-0.32	0.28-0.30	0.26-0.28	0.27	0.26-0.28
$\alpha$	0.14-0.22	0.12-0.16	0.09-0.10	0.12-0.15	0.16	0.12-0.15
$\beta$	0.24-0.25	0.20-0.25	0.23-0.24	0.20-0.26	0.22	0.17-0.23
$\delta$	0.04-0.08	0.04	0.04	zero	0.04	0.04-0.05
$\gamma$	0.24-0.26	0.20-0.24	0.24-0.25	0.24-0.28	0.24	0.24-0.28
$\pi$	0.04-0.06	0.08-0.12	0.04-0.06	0.04-0.05	0.02	0.02-0.05
Alar index	0.60-0.89	0.60-0.62	0.41	0.57-0.60	0.71	0.65-0.68
Palp	0.44-0.48	0.50	0.45	0.45-0.50	Missing	0.43-0.52
Proboscis	0.15-0.16	0.17-0.18	0.14-0.16	0.16-0.18	0.15	0.14-0.15
A3	0.08-0.09	0.07-0.08	0.08-0.11	0.09-0.10	Antennae missing	0.07-0.09
X wing length	0.06-0.07	0.06	-----	-----		0.05-0.06
X labrum	0.78-0.80	0.68	0.84-1.1	0.81-0.90		0.63-0.69
X A4+A5	0.75-0.81	0.79	0.80-0.93	0.81-0.87		-----
Ascoid length	0.02	0.02	0.02-0.02	0.02		0.02
Ascoid/A3	0.23-0.27	0.26	0.20-0.24	0.20		0.22-0.28
2 ascoids and their Position on A3		0.63	0.66	0.56		0.68
on A4		0.48	0.31	0.38		0.39
on A5		0.43	0.33	0.34		0.36
Single papilla and its position on A3	0.67	-----	0.63	0.84		0.83
on A4	0.34		0.68	0.74		0.61
on A5	0.33		-----	-----		-----
Labrum length	0.10-0.12	0.10-0.12	0.10	0.11	0.12	0.11-0.13-
Sensilla depth	0.02	0.02	0.03	0.02	0.32	0.024
Hypopharynx	apex pointed, lateral margins undulating	apex and margin weak undulating	apex pointed	smooth teeth, apex 0.00 broad	14 fine undulation on each side	apical and lateral margins strongly undulating
Breadth	0.00	----	0.01	0.00	0.00	0.00
Teeth	----	14 on each side	14 lateral undulations		6 minute pointing teeth	4 teeth per 0.004
Dental depth	0.02	0.03	0.02	0.02	0.03	0.02
Maxilla Teeth	4 teeth per 0.008	5 lateral, 23 ventrals	3 lateral and 31 ventrals 5 teeth per 0.008	----	2 lateral and 29 ventral teeth	4 lateral, 23 ventral 6 teeth per 0.004
Dental depth	0.06	0.06	0.06		0.07	0.06
Breadth	0.00	---	0.01			0.00
Mandible	narrow, apex more pointed, fine re-curved teeth	strong re-curved teeth	narrow	0.008 broad, shar re-curved teeth	narrow,	narrow, fine re-curved teeth
Teeth	5 teeth per 0.004	5 teeth per 0.01	8 teeth per 0.008	5 teeth per 0.004	5 teeth per 0.004	6 teeth per 0.004
Dental depth	0.04	0.06	0.05	0.05	0.05	0.04
Cibarium	0.04 broad	0.05-0.06 broad	0.03-0.04	0.04 broad	0.05	0.40-0.04
Teeth	20-22 uniform teeth on a curved arc,	28 uniform teeth on an arc	16-20 uniform teeth on a curved arc	16 indistinct teeth	5-6 very large pointed teeth at each sides, about 3-4 short thick pointed median teeth arranged on a sharp curved line, lateral denticles present	17-20 teeth on arc, lateral 6-7 sharply pointed larger, 6 medial smaller teeth, base of teeth without denticles

Table 2: Continue

Key parameters	<i>S. fallax</i>	<i>S. punjabiensis</i>	<i>S. murghabiensis</i>	<i>S. mervynae</i>	<i>S. d. carpaktensis</i>	<i>S. t. pashtunica</i>
Pigment patch	oval	very dark (0.034 long, 0.022 broad)	0.02 long, 0.01 broad	conical	broad triangular	broad curved
Anterior process	absent	absent	short	long	absent	absent
Pharynx	much dilated posteriorly	hind width very broad	less dilated posteriorly	marked posterior dilation, base of the pharynx with membranous part posterior margin with lateral constriction		much dilated posteriorly
Length/breadth	1.62-1.87	1.45-1.47	2.02	2.41-2.58		2 times
Anterior part/					hind width twice as anterior width	
Posterior part	2.10	3.68	2.82	3.62	long slender teeth and small rounded denticles posteriorly	3.3 times
Armature	yellow pigmented sharply curved lines	very long spicules obliquely down to the center, basal with short denticles	large pigmented teeth 0.02 long, posterior part with small denticles	antero-central and lateral armature composed of group of long spines pointing towards center		yellow pigmented, horizontal straight lines, denticles posteriorly
Base with	a median notch	median notch	basal border	base without	no depression	median slight depression
Spermatheca	(0.01 deep) convex tubular, capsule smaller,	straight or tubular	notch capsule more rounded	tubular	Damaged	tubular, capsule larger passing without any boundary into a short individual duct joining with a common duct
Individual ducts			0.04 long, 0.01 broad			
Open into	a common duct	a common duct	a common duct 0.02 broad			
Genital atrium	0.02 broad	0.06	0.04	0.04		0.04
Furca length	0.07	0.05	0.08	0.07		0.07

were found to be greater whereas of *S. punjabiensis* were observed to be of shorter. Similarly, Ascoid/A4 and Ascoid/A5 of *S. mervynae* were noted to be of greater as compared with of other species. Number of cibarial teeth was also noted to be taxonomic value. Coxite/A3 of *S. punjabiensis* was found to be greater. Genital filament/pump of *S. fallax* were observed to be greater while shortest were found of *S. murghabiensis*.

In female flies, alar index of *S. fallax* were noted to be greater whereas the shortest one was of *S. murghabiensis*. Similarly, A3/labrum of *S. murghabiensis* were noted to be of greater while shortest were of the *S. t. pashtunica*. Dental depth of maxilla and of labrum were also observed to be of diagnostic significance. Similarly, posterior dilation of the pharynx, length/breadth and anterior part/posterior parts ratio were also found to be of discriminating value.

It can be suggested that aforementioned key parameters of the subgenus *Sergentomyia* further facilitate the correct identification of the species and should also be taken into account in taxonomic studies of this subgenus.

## REFERENCES

- Lewis, D.J., 1967. The Phlebotomine sandflies of West Pakistan (Diptera, Psychodidae). Bull. Brit. Mus. Nat. Hist. (Ent.), 19: 1-57.
- Parrot, L., 1921. Sur une variete nouvelle de *Phlebotomus minutus* Rondani. Bull. Soc. Hist. nat. Afri. nord., 12: 37-40.
- Sinton, J.A., 1933. Notes on some Indian species of the genus *Phlebotomus* XXXVI. Diagnostic table for the males of the species recorded from India. Indian J. Med. Res., 21: 417-427.
- Perfiliev, P.P., 1939. Data on the sandfly fauna of the USSR, I. Revision of the minutus group of Phlebotomus. Trudy Voenno-med. Akademii. Im. Kirova, 19: 75-95.
- Pringle, G., 1953. The sandflies (*Phlebotominae*) of Iraq. Bull. Ent. Res., 43: 707-737.
- Perfiliev, P.P., 1933. Uber neue mucken aus Mittelasien (Turkmenistan). Zool. Anzeiger., 7-8, 101: 221-227.

7. Artemiev, M.M., 1974. Sandflies (Diptera, Psychodidae, Phlebotominae) of eastern Afghanistan. Communication II. Genus *Sergentomyia*, subgenus *Sergentomyia*. *Med. Parazit.*, 43: 328-334
8. Johnson, P.T., E. McConnell and M. Hertig, 1963. Natural infections of leptomonad flagellates in Panamanian Phlebotomus sandflies. *Exp. Parasitol.*, 14: 107-122.
9. Lewis, D.J., 1973. *Phlebotomidae* and *Psychodidae*. In: *Insects and other Arthropods of Medical Importance*. (K.G.V. Smith, Ed.), British Museum (Natural History), London, pp: 159-179.
10. Killick-Kendrick, R., 1983. Investigation of Phlebotomine sandflies-vectors of Leishmaniasis. In: *Proceedings of the Indo-UK Workshop on leishmaniasis*. Patna, India, December, 6-10, 1982, pp: 72-83.
11. Killick-Kendrick, R., Y. Tang, M. Killick-Kendrick, R.N. Johnson, P.M. Ngumbi, D.K. Sang and P.G. Lawyer, 1994. Phlebotomine sandflies of Kenya (Diptera, Psychodidae) III. The identification and distribution of species of the sub genus *Larrousius*. *Ann. Trop. Med. Parasit.*, 88: 183-196.
12. Lewis, D.J., 1978. The Phlebotomine sandflies (Diptera, Psychodidae) of the Oriental Region. *Bull. Brit. Mus. Nat. Hist. (Ent.)*, 37: 217-343.
13. Lewis, D.J., 1982. A taxonomic review of the genus *Phlebotomus* (Diptera, Psychodidae). *Bull. Brit. Mus. Nat. Hist. (Ent.)*, 45: 121-209.
14. Artemiev, M.M., 1978. Sandflies (Diptera, Psychodidae, Phlebotominae) of Afghanistan. Kabul, pp: 91.