http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 7 (1): 53-57, 2004
ISSN 1028-8880

Taxonomic Morphology of *Sergentomyia punjabiensis* Sinton (1933) from Pakistan (Diptera, Psychodidae, Phlebotominae)

Juma-Khan Kakarsulemankhel
Sandflies-Leishmaniasis and Mosquitoes Lab./Zoology, University of Balochistan, Quetta, Pakistan

Abstract: During entomological surveys conducted by the author in the whole of Balochistan Province during 1996-2001, *Sergentomyia (Sergentomyia) punjabiensis*, Sinton was collected (*N*=22) from 5 localities. These localities appear to be the new records of this species in the literature to date. Taxonomic characters not described by earlier workers are described and illustrated. A review of the currently known distribution of this species is also given. Results are compared with the data available in the existing literature. Differential diagnosis of this species is also given.

Key words: Sandfly, *Sergentomyia punjabiensis,* taxonomic characters

Phlebotomus antennatus sp. nov. was described by Newstead (1912) (♀, collected from Salaga, Gold coast, West Africa by Dr. G.E.H. Le Fanu on 19th.June, 1911), who observed that this species may be distinguished at once by the short, stout form of the antennal segments, of which the third to the thirteenth, inclusive were much more bead-like than those of any other species. Paired ascoids were present on the third to the fifteenth segments. Later, Newstead and Sinton (1921) thought that the evidence then available was insufficient to separate it from *Phlebotomus minutus* and, therefore, they placed it as a variety of that species. Sinton (1933) later found that the differences between both ♀ and ♂ forms of Indian specimens of the two insects were so distinct that he considered that *Phlebotomus antennatus* should again be raised to specific rank, although the identity of the Indian form of the species with the original African type was uncertain and the name of *Phlebotomus punjabiensis* was proposed for this species as it seemed most prevalent in the Punjab. Theodor (1933) concluded that the two forms were not identical.

Sergentomyia punjabiensis has been reported to occur in Balochistan as well as in other parts of Pakistan (Qutubuddin, 1951; Lewis, 1967; Aslamkhan and Rafique, 1980 and Aslamkhan, 1996) but morphometric measurements, description and illustrations of taxonomic characters of this species were not supplied by the above cited authors except Lewis (1967) who while describing this species from Pakistan did not give illustrations of wing, antennae, maxilla, mandible, hypopharynx, palps, genital furca and genital atrium of female and also wing, antennae, palps and genital pump of the male. However, Lewis (1978) later on described and sketched only the labrum, hypopharynx, mandible and maxilla of this species, however, wing, antennae, hypopharynx, palps, genital furca and genital atrium of female and also the wing, antennae, palps and genital pump of this species were remained un-described and un-figured in the literature. In view of the insufficient description of Qutubuddin, Lewis, Aslamkhan and Rafiq and Aslamkhan (*loc. cit.*), *Sergentomyia punjabiensis* is redescribed in detail.

MATERIALS AND METHODS

A taxonomic study of species of sandflies prevalent in the whole of the Balochistan Province was conducted by the present author during 1996-2001 and 2013 sandflies were collected comprising of the genera, *Phlebotomus, Sergentomyia and Grassomyia* (Kakarsulemankhel, 2001). Flies were collected, processed, preserved, dissected and mounted according to the conventional methods especially those adopted by Johnson *et al.* (1963), Lewis (1973), Killick-Kendrick (1983), Lawyer *et al.* (1991) and Killick-Kendrick *et al.* (1994). Keys for species identification furnished by Lewis (1967) were followed. All the diagrams were drawn with the help of camera lucida and are to the given scales. Measurements are in millimeter unless otherwise indicated

Sergentomyia (Sergentomyia) punjabiensis Sinton (1933) (Fig. 1 and 2 and Table 1 and 2)

Female: (6 specimens examined) (Fig. 1). Head 0.336 long, 0.368 broad, Eye 0.156 (0.136-0.176) long, 0.148 (0.12-0.176) broad, the distance between eyes 0.16. Wing (Fig. 1A) 1.16 (1.12-1.20) long, 0.285 (0.256-0.32) broad. α= 0.14 (0.12-0.16) long, β= 0.228 (0.20-0.256) long, δ=0.04, but in 2 specimens from Sibi, δ was measured to be zero.

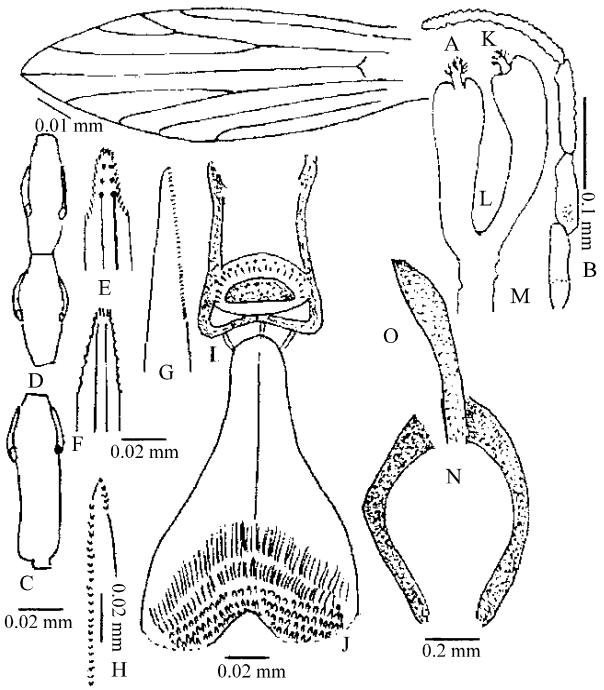

Fig. 1: Camera Lucida drawings of *Sergentomyia punjabiensis* (♀) showing: wing (A), palps (B), the third (C), fourth (D,lower) and fifth (D, upper) antennal segments, labrum (E), hypopharynx (F), mandible (G), maxilla (H), cibarium (I), pharynx (J), spermatheca (K), individual duct (L), common duct (M), genital atrium (N), genital furca (O).

γ=0.22 (0.20-0.24) long, π=0.10 (0.08-0.12), alar index=0.614 (0.6-0.625). Proboscis 0.17-0.18 long. Palps (Fig. 1B) 0.5 long, palpal formula 1,2,3,4,5, with relative length 10:23:34:4:76. P3 has 10-13 spatulate Newstead's sensilla at its anterior basal third of segment. A3 (Fig. 1C) 0.075 (0.07-0.08) long, A3 was 0.223x length of the head, 0.48x length of eye, 0.064x length of wing, 0.416x length of proboscis, 0.681x length of labrum, 0.797x length of A4+5, ascoid on A3 was 0.02 long and it was situated at 0.636 of the A3 and was of 0.266x length of A3. A4 (Fig. 1D, lower) 0.047 (0.044-0.050) long, ascoid on A4 was 0.02 long and it was situated at 0.48 of the A4 and was of 0.425x length of A4. A5 (Fig. 1D, upper) 0.047 (0.044-0.050) long, ascoid on A5 was 0.02 long, and it was situated at 0.43 of the A5 and was of 0.425x length of A5. Ascoid formula: 2/3-15. Labrum (Fig. 1E) 0.11 (0.10-0.12) long, with 3 apical small sensilla and adorals relatively larger, sensilla depth 0.028. Hypopharynx (Fig. 1F) with14 teeth on each side, apex and margins of hypopharynx were weak undulating and dental depth was of 0.032. Mandible (Fig. 1G) 0.018 broad, with 5-6 strong re-curved denticles per 0.01 and a dental depth 0.064. Maxilla (Fig. 1H) with 5 lateral and 23 ventral teeth and a dental depth of 0.068. Cibarium (Fig. 1I) 0.058-0.06 broad, chitinous arch absent or weakly developed, about 28 cibarial teeth uniform and equal sized, arranged on a convex row, pigment patch very dark, 0.034 long and 0.02 broad. Pharynx (Fig. 1J) 0.13-0.14 long, hind width very broad, about 0.092 (0.088-0.096) broad, pharynx 1.45-1.47 times as long as wide, hind width 3.68 times fore width. The anterior edge of pharyngeal armature forms an almost convex line and pharynx with a deep, basal, median notch about 0.01 deep, basal and most posterior armature was in the form of short denticles occupying about 0.016 height whereas median apical and lateral apical armature was composed of vary long spicules obliquely down to the center and occupying about 0.034 height and pharyngeal teeth occupy 0.370x length of pharynx. Female genitalia: spermatheca (Fig. 1K) tubular with anterior breadth 0.04 and central breadth 0.024, spermathecal ducts delicate (Fig. 1L) 0.02 broad and a common duct (Fig. 1M) with a common opening in to genital atrium (Fig. 1N) which was 0.06 broad and genital furca (Fig. 1O) 0.056 long.

Male: (3 specimens examined) (Fig. 2). Wing (Fig. 2A) 0.96-1.04 long, 0.224-0.24 broad, α=0.08-0.096 long, β=0.2-0.24 long, δ=zero to –0.032, γ=0.2-0.24, π=0.064-0.104 long, alar index 0.4. Palps (Fig. 2B) 0.49 long, palp formula 1,2,3,4,5 and palpal ratio 1,3, 5, 5.5,10. A3 (Fig. 2C) 0.08 long, A3 /wing length=0.076-0.083, A3/ labrum=0.714, A3/A4+5=0.78-0.8, ascoid 0.01 long, position of ascoid on A3=0.675, position of a single papilla=0.65, ascoid 3/ A3=0.125. A4 (Fig. 2D, lower) 0.05-0.052 long, ascoid 0.014 long, position of ascoid on A4=0.36, position of a single papilla on A4=0.69, ascoid 4/A4=0.269-0.28. A5 (Fig. 2D, upper) 0.052 long, ascoid 0.014 long, position of a single ascoid on A5= 0.038, ascoid 5/A5=0.27. There was a single ascoid on segments AIII to XV. Labrum (Fig. 2E) 0.112 long, 0.025 broad and a sensilla depth of 0.036. Hypopharynx (Fig. 2F) apex pointed, 0.012 broad and a dental depth 0.033. Cibarium (Fig. 2G) 0.042 broad, with about 18 uniform pointed teeth and a few dot like denticles scattered at the bases of teeth, a slightly brown short triangular pigment patch present, chitinous arch and anterior process both absent. Pharynx (Fig. 2H) flask shaped, 0.11-0.13 mm long and was 2.4-2.6 times as long as broad and its widest posterior portion was 1.64-1.66 times wide as the narrowest anterior part. There was marked posterior dilation of this structure. Anterior edge of armature formed a convex line. Pharyngeal armature consists of a series of weak, faint, short, straight and curved lines. Armature occupied 3.25-4.58 of pharynx.

Table 1: Comparison of taxonomic characters of *Sergentomyia punjabiensis*

♀	Taxonomic Characters	Balochistan (Present study)	Punjab and NWFP. Pakistan (Lewis, 1967: 27)
Wing	Length	1.16 (1.12-1.20)	1.40 (1.21-1.50)
	Breadth	0.285 (0.256-0.32)	0.31(0.28-0.33)
	Alar index	0.614 (0.6-0.625)	0.6 (0.4-0.9)
Labru m	Length	0.11(0.10-0.12)	0.14 (0.13-0.15)
A3	Length	0.075 (0.07-0.08)	0.09 (0.08-0.09)
A3/ Labrum		0.666-0.7	0.65 (0.6-0.7)
A3/ A4+5		A3<A4+5	A3<A4+5
Ascoid 4/ A4		0.425	0.4
Palpal formula		1,2,3,4,5	1,2 (3-4), 5 or 1,2,3,4,5
Palpal ratio		10:23:34:44:76	10:12:13
Cibarium		With about 28 uniform equal sized teeth arranged on a convex line, pigmented patch broad and dark, chitinous arch absent or ill developed.	With about 30 nearly uniform teeth about 10 punctiform teeth present, pigment patch broad and very dark, chitinous arch absent.
Pharynx		1.45-1.47 times as long as wide with sharply defined deeply median notch at the base.	1.3-1.8 times as long as hind width with sharply defined deeply notched posterior out line
Spermatheca		Tubular, with delicate ducts	Tubular with delicate ducts.

Table 2:

♂	Taxonomic Characters	Balochistan (Present study)	Punjab, NWFP Pakistan (Lewis, 1967:27)
Wing	Length	0.96-1.04	1.35 (1.28-1.47)
	Breadth	0.224-0.24	0.27 (0.25-0.29)
Labrum	Length	0.112	0.13 (0.12-0.14)
A3	Length	0.08	0.10 (0.09-0.11)
A3 / Labrum		0.714	0.8 (0.7-0.8)
A3 / A4+5		0.78-0.8	A3<A4+5
Ascoid 4/A4		0.36	0.3
Cibarium		With about 18 uniform, pointed teeth and few dot like denticles scattered at the bases of teeth, a slightly brown short triangular pigment patch, chitinous arch absent	With about 20 nearly equal, pointed teeth and a few small punctiform teeth, pigment patch variable, usually short and broad, chitinous arch absent.
Pharynx		Armature consists of a series of weak, faint, short, straight and curved lines	Pharynx with faint scaly sculpturing
Style		With 4 apical spines and seta at 0.75	With 4 apical spines, seta at about 0.7
Paramere		With beak like apex	With beak like apex
Aedeagus		Thick, with rounded ends.	Thick and curved with rounded ends.
Genital Filament / Pump		3.0-3.25	3.5

Male terminalia: coxite (Fig. 2I) 0.19-0.2 long, 0.068-0.076 broad, coxite/A3=2.37-2.5, coxite /labrum=1.69-1.78, coxite/ style=2.5-2.71. Style (Fig. 2J) 0.07-0.08 long, with 4 apical spines, spines were as long as style or longer than style, a short ventral seta (0.016 long) at 0.75. Paramere (Fig. 2K) 0.11 long, with a broad base and a long neck with beaked end, 0.64% of the paramere body was 0.04 long, whereas 0.45% of the paramere body was in the form of a long neck (0.008 broad) which ends like a bird's head, a ventral tubercle with 3-4 scattered short hairs. Aedeagus (Fig. 2L) about 0.07 long, very thick and broad base (about 0.03) and apex of aedeagus 0.01 broad. Genital filament (Fig. 2M) smooth, 0.24-0.26 long, pump (Fig. 2N) 0.08 long and filament to pump ratio=3.0-3.25. Surstyle (Fig. 2O) 0.15-0.16 long, 0.79-0.80 of coxite.

Differential diagnosis of *S. punjabiensis:* Very short (A3=0.07-0.08 long) and bead like antennal segments, short labrum (0.10-0.12), ascoid 4/A4 (0.425) and the morphology of the pigment patch, cibarial and pharyngeal armature, the shape of pharynx and spermathecae are useful diagnostic characters in the identification of ♀ of this species. In the ♂, shorter and bead like antennal segments (A3=0.08 long), shorter labrum (0.112), ascoid 4/A4 (0.27-0.28), morphology of cibarium, pharynx and shape of male terminalia specially style, paramere and aedeagus are useful aids in the identification.

Distribution: Balochistan: New Record, Present survey: Belpat, Dhadar, Lehri, Uthal. These localities are important foci of cutaneous leishmaniasis. Flies were collected using mouth aspirator and contact traps from indoors.

Dera Bugti (Aslamkhan,1996), Kahan (Aslamkhan, 1996), Quetta (Lewis, 1967; Aslam Khan, 1996), Sibi (Aslamkhan and Rafique, 1980 and Aslamkhan, 1996) present survey), Talli (Aslamkhan, 1996). N.W.F.P.: Bannu (Sinton's notes), Dera Ismail khan (BMNH), Idak (BMNH), Kohat (Sinton's notes), Peshawar (BMNH,

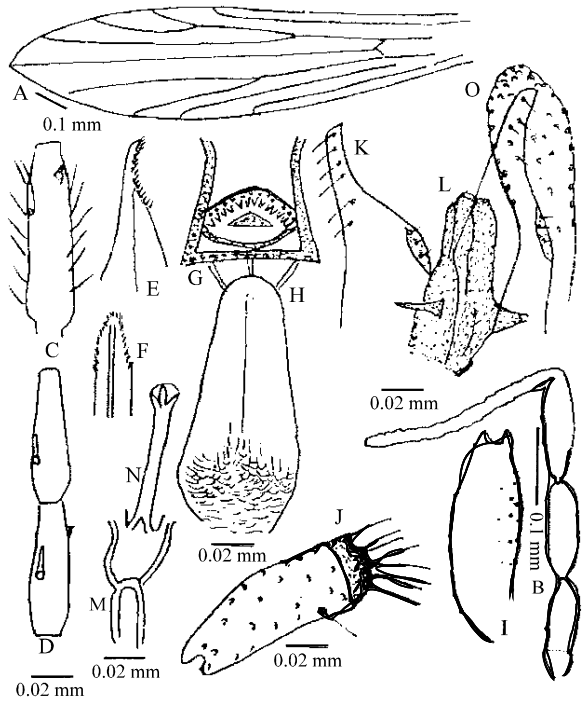

Fig. 2: Camera Lucida drawings of *Sergentomyia punjabiensis* (♂) showing: wing (A), palps (B), the third (C), fourth (D, lower) and fifth (D, upper) antennal segments, labrum (E), hypopharynx (F), cibarium (G), pharynx (H), coxite (I), style (J), paramere (K), aedeagus (L), genital filament (M), pump (N), surstyle (O).

Aslamkhan and Barnett, 1966 and 1967; Lewis, 1967; Safi, 1993; Aslamkhan, 1996, Coll. Dr. M. Suleman, viii, 1995), Tank (Sinton's notes). Punjab: Dera Ghazi khan (Aslamkhan, 1996), Faisalabad (Sinton's notes), Gujrat (Aslamkhan, 1996), Jhelum (BMNH), Khanki (Aslamkhan, 1996), Shahzada, near Lahore (Lewis, 1967), Lahore (BMNH; Sobti, 1945; Nasir, 1958; Aslamkhan and Barnett, 1966 and 1967 and Aslamkhan, 1996), Mangowal (Lewis, 1967), Rawalpindi (Lewis,1967), Saidpur, near Rawalpindi (Lewis, 1967), Sargodha (Lewis, 1967).

DISCUSSION

Results of the present study are compared with the published data of *S. punjabiensis* from other territories (Table 1 and 2). *S. punjabiensis* (♀) from Balochistan differ in shorter wing length, alar index, labrum and A3 and ♂ differs in shorter labrum, A3 and wing with the published data of this species from other parts of Pakistan (Lewis, 1967). *S. punjabiensis* (♀) closely resembles in hypopharynx, mandible, maxilla, A3/labrum, A3<A4+5, ascoid 4/A4, palpal formula, morphology of cibarium, pharynx and spermatheca with the published data of this species from other parts of Pakistan (Lewis, 1967). The ♂ of this species from Balochistan also resemble in A3/labrum, A3<A4+5, morphology of cibarium, pharynx, style, paramere, aedeagus and genital filament /pump ratio with the published data of this species from other parts of Pakistan.

The results of the present study revealed that *S. punjabiensis* is a rare species (22/2013,1.09%) and has a localized distribution in Pakistan. Sinton (1932) reported that *P. minutus var. antennatus (S. punjabienis)* had a more general distribution over the Indo Pakistan plains than did *P. minutus (S. theodori)* There are no published reports incriminating *P. punjabiensis,* which is thought to be thermophilic and hydrophilic and presumably plays no part in transmitting *Leishmania* to man.

REFERENCES

Aslamkhan, K., 1996. Biodiversity of sandflies (Phlebotominae) of Pakistan. M.Sc. Thesis. Department of Zoology, Government College, Lahore, Punjab University, Pakistan, pp: 144.

Aslamkhan, M. and H.C. Barnett, 1966. Studies on the bionomics of sandflies. Ann. Rept. Univ. Md. Sch. Med. ICMR., pp: 54-65.

Aslamkhan, M. and H.C. Barnett, 1967. Studies on Sandfly fever and on the bionomics of sandflies. Ann. Rept. Univ. Md. Sch. Med. ICMR., pp: 129-157.

Aslamkhan, M. and S. Rafique, 1980. Studies on cutaneous leishmaniasis and sand flies of Balochistan. Annual Report, University of Maryland School of Medicine, ICMR., pp: 315-324.

Johnson, P.T., E. McConnell and M. Hertig, 1963. Natural infections of leptomonad flagellates in Panamanian Phlebotomus sandflies. Exp. Parasitol., 14: 107-122.

Kakarsulemankhel, J.K., 2001. The fauna of the Phlebotomine sandflies (Diptera, Psychodidae) in Balochistan, Pakistan and the disease cutaneous leishmaniasis. Ph.D. Thesis. Department of Zoology, University of Balochistan, Quetta, Pakistan, pp: 389.

Killick-Kendrick, R., 1983. Investigation of Phlebotomine sandflies-vectors of leishmaniasis. Proceedings of the Indo-UK workshop on leishmaniasis, pp: 72-83.

Killick-Kendrick, R., Y. Tang, M. Killick-Kendrck, 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 subgenus Larroussius. Ann. Trop. Med. Parasit., 88: 183-196.

Lawyer, P.G., Y.B. Mebrahtu, P.M. Ngumbi, P. Mwanyumba, J. Mbugua, G. Kilu, D. Kipkoech, J. Nzovu and C.O. Anjilli, 1991. *Phlebotomus guggisbergi* (Diptera, Psychodidae), a vector of *Leishmania tropica* in Kenya. Am. J. Trop. Med. Hyg., 44: 290-298.

Lewis D.J., 1967. The Phlebotomine sandflies of west Pakistan. Bull. Brit. Mus. Nat. Hist. (Ent.)., 19: 1-57.

Lewis, D.J., 1973. Phlebotomidae and Psychodidae. In Smith K.G.V. (ed.) Insects and other Arthropods of medical importance. British Museum Natural History, London, pp: 155-179.

Lewis, D.J., 1978. The phlebotomine sandflies (Diptera, Psychodidae) of the Oriental Region. Bull. Brit. Mus. Nat. Hist. (Ent.)., 37: 217-343.

Nasir, A.S., 1958. Sandfly fauna in west Pakistan. Pak. J. Hlth., 8: 21-22.

Newstead, R., 1912. Notes on Phlebotomus, with description of new specie. Part I. Bull. ent. Res., 3: 361-367.

Newstead, R. and J.A. Sinton, 1921. On a collection of papataci flies (Phlebotomus) from India. Ann. Trop. Med. Parasit., 15: 103-106.

Qutubuddin, M., 1951. The sandfly fauna of the Kohat valley, N.W.F.P. Pakistan. Pakistan J. Hlth., 1: 34-36.

Safi, F.S., 1993. A contribution to the sandfly fauna of Peshawar. M.Sc. Thesis. Department of Zoology, Government College, Lahore, Punjab University, pp: 61

Sinton, J.A., 1932. Notes on some Indian species of the genus *Phlebotomus*. XXX. Diagnostic table for the females of the species recorded from India. Indian J. med. Res., 20: 55-74.

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.

Sobti, D.K., 1945. Systematic study, seasonal prevalence and bionomics of sandflies of Lahore. M.Sc. Thesis. Deptartment of Zoology, Government College, Lahore, Punjab University, Pakistan, pp : 69.

Theodor, O., 1933. Some African sandflies. Bull. ent. Res., 24: 537-547.