

## ABOUT THE PRESENCE OF *PHLEBOTOMUS SERGENTI* PARROT, 1917 (DIPTERA: PSYCHODIDAE) IN EASTERN SICILY, ITALY

D'URSO V.\*, RUTA F.\*, KHOURY C.\*\*, BIANCHI R.\*\*, DEPAQUIT J.\*\*\* & MAROLI M.\*\*

### Summary:

The note reports the data of a three-year sand fly investigation (1997-99) carried out in Eastern Sicily (Italy) with the aim to study the distribution of *Phlebotomus sergenti*. The survey involved a densely inhabited area at the foot of Mount Etna and the area of Iblei mounts. A total of 9,095 sand flies, of which 63.4 % males, were captured. Five species belonging to the genus *Phlebotomus* (*P. perniciosus*, *P. perfiliewi*, *P. neglectus*, *P. sergenti* and *P. papatasi*) and one to the genus *Sergentomyia* (*S. minuta*) were identified. Both the prevalence and distribution of the species were different within the two areas studied. In Mount Etna area, *P. perniciosus* (77.7 %) was the prevalent species followed by *S. minuta* (19.8 %), *P. sergenti* (2.0 %), *P. neglectus* (0.3 %) and *P. papatasi* (0.2 %). While in Iblei mounts region *S. minuta* (84.5 %) showed the highest prevalence, followed by *P. perniciosus* (14.4 %), *P. perfiliewi* (0.9 %) and *P. neglectus* (0.1 %). Here, *P. sergenti* was a very rare species (< 0.02). *P. sergenti* was mostly associated to domestic habitats of peri-urban and urban zones located between two and 750 m a.s.l. The density values of *P. sergenti*, expressed as number of specimens/m<sup>2</sup> of sticky trap, were between 0.3 and 5.5 with the highest value in the hilly collecting sites. The low observed abundance of *P. sergenti* does not allow to draw any prediction on the role that the species could play in the transmission of leishmaniasis in Sicily.

**KEY WORDS :** *Phlebotomus sergenti*, distribution, cutaneous leishmaniasis, Sicily, Italy.

**Résumé :** SUR LA PRÉSENCE DE *PHLEBOTOMUS SERGENTI* PARROT, 1917 (DIPTERA: PSYCHODIDAE) DANS L'EST DE LA SICILE (ITALIE)

Les auteurs rapportent les résultats d'une enquête entomologique menée durant trois années (1997-1999) à l'aide de pièges adhésifs dans l'est de la Sicile (Italie) avec l'objectif d'étudier la distribution de *Phlebotomus sergenti* dans une région très peuplée au pied de l'Etna et dans celle des Monts Iblei. 9095 phlébotomes ont été capturés parmi lesquels 63,4 % de mâles. Cinq espèces appartenant au genre *Phlebotomus* (*P. perniciosus*, *P. perfiliewi*, *P. neglectus*, *P. sergenti* et *P. papatasi*) et une appartenant au genre *Sergentomyia* (*S. minuta*) ont été identifiées. La prévalence et la distribution de ces espèces varient selon la zone prospectée. Dans la région de l'Etna, *P. perniciosus* est l'espèce la plus abondante (77,7 %) suivie dans l'ordre décroissant par *S. minuta* (19,8 %), *P. sergenti* (2 %), *P. neglectus* (0,3 %) et *P. papatasi* (0,2 %). Dans la zone des Monts Iblei, *S. minuta* est l'espèce la plus abondante (84,5 %) suivie par *P. perniciosus* (14,4 %), *P. perfiliewi* (0,9 %), *P. neglectus* (0,1 %) et *P. sergenti*, extrêmement rare dans cette zone (< 0,02 %). Cette dernière espèce est presque toujours associée à des habitats domestiques en zone urbaine ou péri-urbaine, à des altitudes comprises entre deux et 750 mètres. Les densités observées varient entre 0,3 et 5,5 *P. sergenti* par mètre carré de papier huilé, les abondances les plus élevées étant corrélées aux reliefs accidentés. Ces faibles abondances ne permettent aucune prédiction quant au rôle joué par *P. sergenti* en Sicile dans la transmission de leishmaniose tropica. Néanmoins, sa distribution et son abondance en Sicile et dans le sud de la péninsule italienne devraient être évaluées périodiquement ainsi que la dynamique populationnelle et son anthropophilie.

**MOTS CLÉS :** *Phlebotomus sergenti*, distribution, leishmaniose cutanée, Sicile, Italie.

## INTRODUCTION

*Phlebotomus sergenti* Parrot, 1917 is recorded in many countries of the Mediterranean basin including Western Europe and Northern Africa. The hypothesis of its migration from Central Asiatic regions and subsequent colonization of the Mediterranean

regions has been recently well documented by Depaquit *et al.* (2002). *P. sergenti* is well known to be involved in the transmission of *L. tropica* in Saudi Arabia (Al-Zahrani *et al.*, 1988), Morocco (Guilvard *et al.*, 1991) and Ethiopia (Gebre-Michael *et al.*, 2004). It is suspected to be the most probable vector in all the foci of CL due to *L. tropica* (Killick-Kendrick, 1990; Killick-Kendrick *et al.*, 1995; Volf *et al.*, 2002), except in some foci from East Africa and Namibia.

In Italy, *P. sergenti* has been reported in the past only from a few localities of Eastern Sicily (Adler & Theodor, 1931; Biocca *et al.*, 1977). The present note reports the data of a three-year entomological survey (1997-1999) aimed to study the distribution of *P. sergenti* in Eastern Sicily.

\* Department of animal biology, University of Catania, Italy.

\*\* MIPI department, Section of vector-borne diseases and international health, ISS, Rome, Italy.

\*\*\* Faculté de pharmacie, Université de Reims Champagne-Ardenne, France.

Correspondence: Michele Maroli.

Tel.: ++39 06 49902302 – Fax: ++39 06 49387065 – E-mail: maroli@iss.it

## MATERIALS AND METHODS

### STUDY AREA

Sicily is the largest island (25,426 km<sup>2</sup>) in the Mediterranean basin. In Eastern Sicily, the highest mountain is Mount Etna (3,340 m.), the biggest volcano in Europe, rising between the Catania plain and the Simeto and Alcantara river valleys and the Sicilian Apennines. Spontaneous vegetation on the coastal areas consists of the evergreen Mediterranean shrubs. The most densely populated areas are the coastal belt near Catania and Messina, around Palermo, Syracuse and the hinterlands of Agrigento and Licata; the inland under populated areas include the highlands of the Sicilian Apennines, the Etna, the Erei, the Iblei and other high ground in the west. The entomological survey was carried out in two different areas in the Eas-

tern region. The first area was the densely inhabited zone at the foot of Mount Etna including ten communes of Catania province and the second was the Iblei mounts region, with six communes located in Syracuse province, four of which were hilly and two coastal, three communes in Ragusa province (one of which coastal) and one hilly commune (Vizzini) in province of Catania.

### SAND FLY COLLECTIONS AND IDENTIFICATION

Thirty collecting sites, containing a variety of sand fly diurnal resting sites in rural, urban and peri-urban areas, were selected throughout the two zones under study (Fig. 1). Characteristics of each site and a list of available hosts within a 50 m radius are presented in Table I.

Sand fly specimens were collected by using sticky traps (20 × 20 cm), soaked in castor oil and left *in situ* for

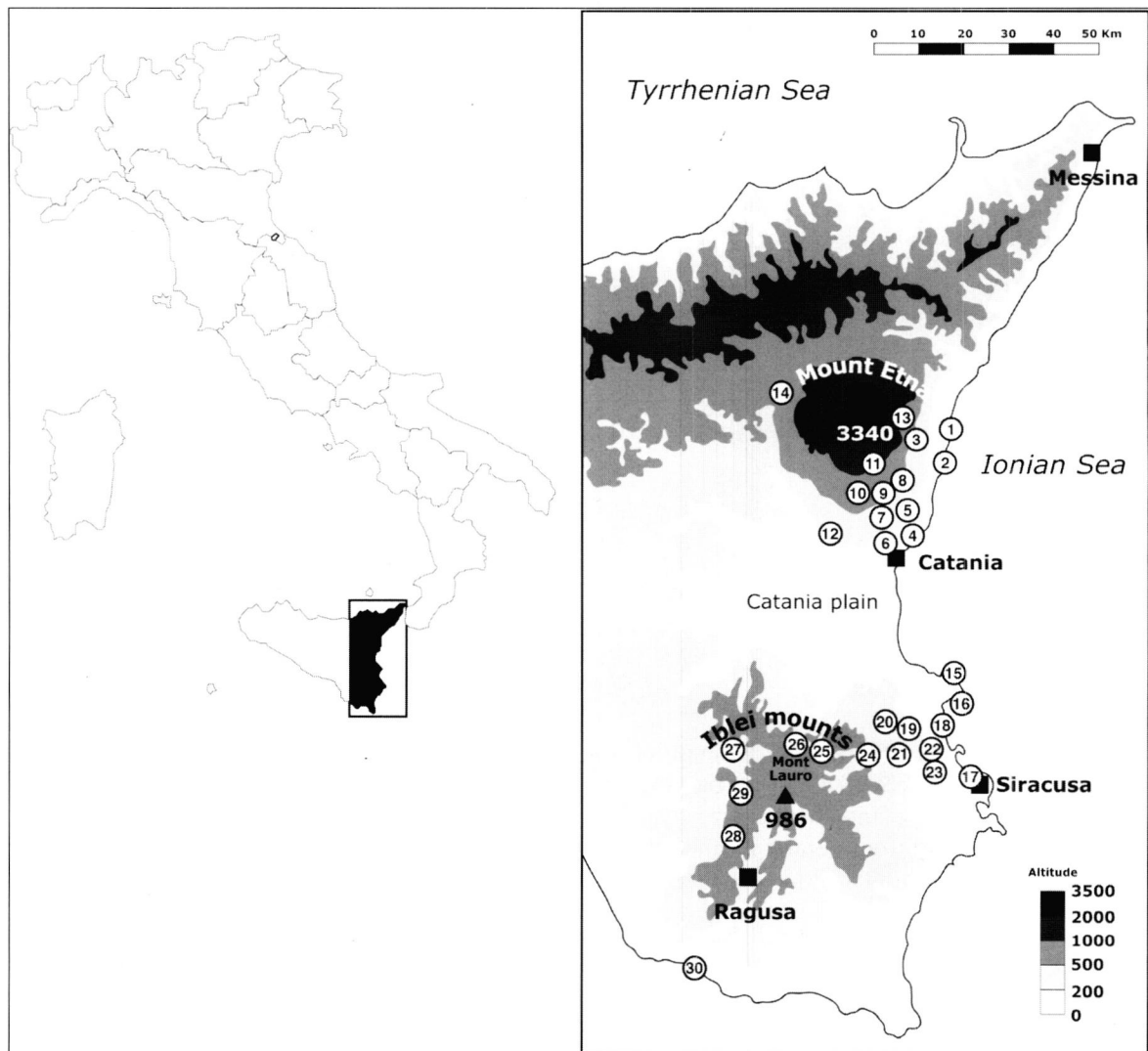


Fig. 1. – Map of Eastern Sicily showing the distribution of the collecting sites (1-30). The commune and the locality of each site are reported in Table I.

three nights. Twice monthly collections were carried out during a seven-month period (May–November) for three consecutive years (1997–1999). Collected specimens were identified by their morphological characteristics according to Theodor (1958) and Léger *et al.* (1983). In particular, the identification of male *P. sergentii* specimens was based on the aspect of the basal

process of the coxite which is curved and narrow (Fig. 2A) and on the number (< 22) of its setae (Depaquit *et al.*, 1998). The globulose style showed two distal spines implanted at the same level (Fig. 2B). For females, the identification was based on the number of rings of the spermatheca (five or less) and the well developed pharyngeal armature. Moreover, the sequencing

Site No.	Commune	Locality	Altitude m a.s.l.	Zone	Habitat	Hosts
<b>Etna area (CT)</b>						
1	Acireale	Pozzillo	20	UR	do	Humans, dogs, cats, rodents, lizards
2	Acireale	S.M. La Scala	2	PE	do	Humans, dogs, cats, rodents, lizards
3	Acireale	Piano d'Api	280	PE	do	Humans, dogs, cats, pigs, chickens, rodents, lizards
4	Acicastello	La Scogliera	5	PE	do	Humans, dogs, cats, rodents, lizards
5	Acicastello	Ficarazzi	180	PE	do	Humans, dogs, cats, chickens, rodents, lizards
6	Tremestieri	Nuovaluce	140	UR	do	Humans, dogs, cats, rodents, lizards
7	S. Gregorio	Guardiola Cantarella	280	RU	wi	Dogs, sheep, rodents, lizards
8	Trecastagni	Pizzo Ferro	550	PE	do	Humans, dogs, chickens, rabbits, rodents, reptiles
9	Mascalucia	Via Caravaggio	600	PE	do	Humans, dogs, rodents, lizards
10	Nicolosi	Cemetery	700	PE	pe	Humans, rodents, lizards
11	Nicolosi	Ragala	750	RU	do	Humans, dogs, cats, chickens, rodents, lizards
12	Belpasso	Kennel	300	RU	pe	Humans, dogs, rodents, lizards
13	Zafferana	Case Salemi	600	PE	pe	Humans, dogs, cats, rodents, lizards
14	Maletto	Balze Soprane	800	RU	pe	Humans, dogs, sheep, rodents, lizards
<b>Iblei area (SR-CT-RG)</b>						
15	Augusta	Brucoli Adonai	20	RU	pe	Humans, dogs, cattle, rodents, lizards
16	Augusta	Brucoli Puzzillo	2	PE	pe	Humans, dogs, cattle, rodents, lizards
17	Siracusa	City	10	UR	do	Humans, dogs, cats, rodents, lizards
18	Augusta	Vignale	50	RU	do	Humans, dogs, rodents, lizards
19	Melilli	Cugnicello	320	RU	wi	Dogs, cattle, chickens, rodents, lizards
20	Melilli	Pagliarazzi	430	RU	do	Humans, dogs, cats, cattle, chickens, rodents, lizards
21	Melilli	S. Giorgio	375	RU	wi	Humans, dogs, rabbits, cattle, rodents, lizards
22	Melilli	Cavittula	160	PE	do	Humans, dogs, cats, rodents, lizards
23	Sortino	Mount Climite	430	RU	wi	Humans, dogs, cattle, sheep, rodents, lizards
24	Sortino	Town	438	UR	pe	Humans, dogs, cats, rodents, lizards
25	Ferla	Town	558	UR	do	Humans, dogs, cats, rodents, lizards
26	Buccheri	Town	895	UR	do	Humans, dogs, cats, rodents, lizards
27	Vizzini	Periphery	619	PE	pe	Humans, dogs, rodents, lizards
28	Chiaromonte Gulfi	Town	668	UR	do	Humans, dogs, rodents, lizards
29	Mounterosso Almo	Town	690	UR	do	Humans, dogs, rodents, lizards
30	Marina di Ragusa	Town	5	UR	do	Humans, dogs, cats, rodents, lizards

CT, Catania; SR, Siracusa; RG, Ragusa; UR, urban; PE, peri-urban; RU, rural; do, domestic; pe, peri-domestic; wi, wild.

Table I. – Characteristics of the collecting sites monitored in Eastern Sicily (1997–1999): locality, altitude, habitat and list of available hosts within a 50 m radius.

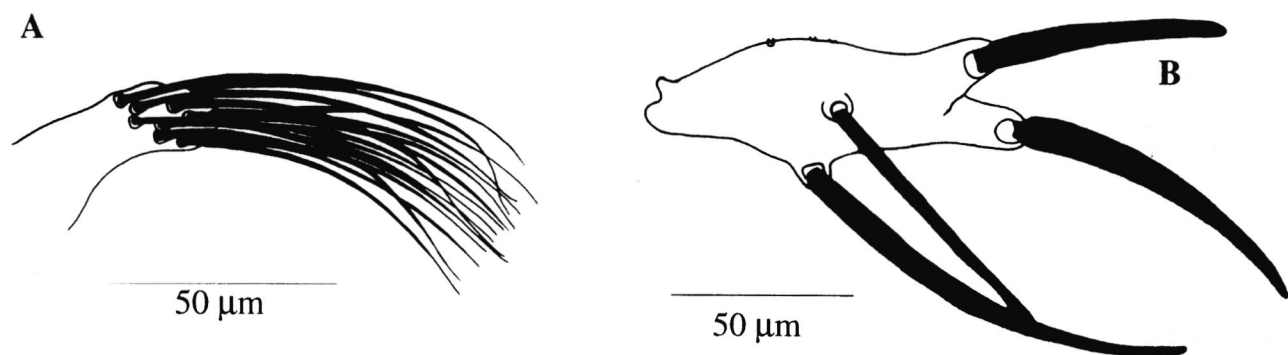


Fig. 2. – Basal process of the coxite (A) and style (B) of a Sicilian *P. sergentii*.

of the second internal transcribed spacer of the ribosomal DNA of one Sicilian specimen (Genbank accession number AF 462330) emphasised without doubt its identity: *P. sergenti* (Depaquit *et al.*, 2002).

## RESULTS AND DISCUSSION

The number of sand flies collected in each site and the prevalence values for the species identified are reported in Table II. Overall, 9,095 sand flies specimens, of which 63.4 % were males, were captured during the three-year study. Five species belonging to the genus *Phlebotomus* Rondani and Berté, 1840 (*P. perniciosus*, *P. perfiliewi*, *P. neglectus* Tonnoir, 1921, *P. sergenti* and *P. papatasi* (Scopoli, 1786)) and one to the genus *Sergentomyia* Franca & Parrot, 1920 (*S. minuta* (Rondani, 1843)) were identified.

On the whole, the more abundant species were *S. minuta* (63.5 %) and *P. perniciosus* (35.0 %). The

other species identified showed percentage value less than 1 %. Among those, *P. sergenti* was the most abundant (0.7 %). Both the prevalence and distribution of the sand fly species were different within the two areas studied (Table II). In the Etna area, *P. perniciosus* (77.7 %) was the most abundant followed by *S. minuta* (19.8 %), *P. sergenti* (2.0 %), *P. neglectus* (0.3 %) and *P. papatasi* (0.2 %). In the less anthropized and dry area of Iblei mounts, the species showed a different prevalence, being *S. minuta* (84.5 %) the most widespread species. In this area, among the *Phlebotomus* genus, the species showed the following prevalence: *P. perniciosus* (14.4 %), *P. perfiliewi* (0.9 %), *P. neglectus* (0.1 %). *P. sergenti* was very rare being only one specimen collected from a rural site located at 420 m a.s.l. The trend of seasonal activity of phlebotomines varied during the three years, being adult flies collected between May-November of each year.

From previous entomological investigations carried out in Sicily at the end of '80, it appears that *P. sergenti* is apparently absent in western and the central areas

No.	Total	<i>P. perniciosus</i>	<i>P. neglectus</i>	<i>P. sergenti</i>	<i>P. perfiliewi</i>	<i>P. papatasi</i>	<i>P. minuta</i>
<b>Etna area</b>							
1	428	380 (88.8)	2 (0.5)	12 (2.8)	–	1 (0.2)	33 (7.7)
2	32	26 (81.3)	–	1 (3.1)	–	–	5 (15.6)
3	12	8 (66.6)	–	2 (16.7)	–	–	2 (16.7)
4	21	19 (90.5)	–	–	–	–	2 (9.5)
5	1,154	991(85.9)	1 (0.1)	20 (1.7)	–	5 (0.4)	137 (11.9)
6	23	20 (87.0)	–	–	–	–	3 (13.0)
7	350	130 (37.1)	–	–	–	–	220 (62.9)
8	120	83 (69.1)	1 (0.9)	9 (7.5)	–	–	27 (22.5)
9	172	92 (53.5)	3 (1.8)	12 (6.9)	–	–	65 (37.8)
10	16	7 (43.7)	–	–	–	–	9 (56.3)
11	129	85 (65.9)	2 (1.5)	1 (0.8)	–	–	41(31.8)
12	465	451 (97.1)	1 (0.2)	3 (0.6)	–	–	10 (2.1)
13	34	6 (17.7)	–	–	–	–	28 (82.3)
14	6	3 (50)	1 (16.7)	–	–	–	2 (33.3)
<b>Total</b>	2,962	2,301 (77.7)	11 (0.3)	60 (2.0)	–	6 (0.2)	584 (19.8)
<b>Iblei area</b>							
15	662	234 (35.3)	2 (0.3)	–	–	–	426 (64.4)
16	3,528	508 (14.4)	–	–	56 (1.6)	–	2,964 (84)
17	20	6 (30)	–	–	–	–	14 (70)
18	14	–	–	–	–	–	14 (100)
19	36	11 (30.5)	–	–	–	–	25 (69.5)
20	529	15 (2.8)	–	1 (0.2)	1 (0.2)	–	512 (96.8)
21	159	6 (3.8)	1 (0.6)	–	–	–	152 (95.6)
22	1,045	89 (8.5)	2 (0.2)	–	–	–	954 (91.3)
23	5	–	–	–	–	–	5 (100)
24	2	1 (50)	–	–	–	–	1 (50)
25	16	3 (18.8)	–	–	–	–	13 (81.2)
26	5	–	–	–	–	–	5 (100)
27	107	8 (7.5)	–	–	–	–	99 (92.5)
28	1	–	–	–	–	–	1 (100)
29	3	1 (33.3)	–	–	–	–	2 (66.7)
30	1	–	–	–	–	–	1 (100)
<b>Total</b>	6,133	882 (14.4)	5 (0.1)	1 (< 0.02)	57 (0.9)	–	5,188 (84.5)
<b>Overall</b>	9,095	3,183 (35)	16 (0.1)	61 (0.7)	57 (0.6)	6 (< .00.1)	5,772 (63.5)

Table II. – Number and percentages of phlebotomine species identified from 30 collecting sites in Eastern Sicily during the sand fly seasons 1997-1999.



of this island (Ansaldi *et al.*, 1990; Maroli *et al.*, 1988, 1990). Our data confirm the presence of *P. sergenti* in Eastern Sicily and show that it is widespread at the foot of Mount Etna, being found in 57.1 % of the collecting sites studied in this area. The species was mostly associated to domestic habitats of peri-urban and urban zones located between two and 750 m a.s.l. The density values of *P. sergenti*, expressed as number specimens/m<sup>2</sup> of sticky trap, were between 0.3 and 5.5 with the highest value in the hilly collecting sites.

The present work has pointed out that in Eastern Sicily *P. sergenti* could easily colonize domestic habitats where it is in close contact with humans and domestic animals. It could be argued that its present abundance is unable to play any role in the epidemiology of leishmaniasis in Sicily. Nevertheless its presence in the biggest island of the Mediterranean basin is of particular importance in view of several factors. Sicily is a bridge between Europe and North Africa. On this subject it is worthy to mention that Depaquit *et al.* (2002), by studying intraspecific variations of different geographical populations of *P. sergenti*, has observed that Sicilian and Moroccan strains appear to be sister populations. Besides, in Morocco a recent investigation has shown that *P. sergenti* is highly susceptible to *L. tropica* (Rioux, 2001). Therefore, considering all the above, there could be a potential risk of *L. tropica* introduction to Sicily. So, it will be useful to continue the monitoring of *P. sergenti* in Sicily and in southern Italy in order to define its future range of dispersion. Moreover, in the neighbouring villages of the Etna zone, a study of the population dynamics and biting activity of the species in relation to the role played on *Leishmania* transmission should be welcome.

## REFERENCES

- ADLER S. & THEODOR O. Investigations on Mediterranean kala azar. III. - The sandflies of the Mediterranean basin. Distribution and bionomics of sandflies in Catania and district. *Proceedings of the Royal Society of London (B)*, 1931, 108, 464-480.
- AL-ZAHRANI M.A., PETERS W., EVANS D.A., CHIN C., SMITH V. & LANE R.P. *Phlebotomus sergenti*, a vector of *Leishmania tropica* in Saudi Arabia. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1988, 82, 416.
- ANSALDI G., LAVAGNINO A., LIBRIZZI R. & MAROLI M. Flebotomi antropofili in Sicilia occidentale: osservazione sulla distribuzione. *Rivista di Parassitologia*, 1990, 51, 217-219.
- BIocca E., COLUZZI A. & CONSTANTINI R. Osservazioni sulla attuale distribuzione dei flebotomi italiani e su alcuni caratteri morfologici differenziali tra le specie del sottogenere *Phlebotomus* (*Larroussius*). *Parassitologia*, 1977, 19, 19-31.
- DEPAQUIT J., FERTÉ H., LÉGER N., LEFRANC F., ALVES-PIRES C., HANAÏ H., MAROLI M., MORILLAS-MARQUEZ F., RIOUX J.A., SVOBODOVA M. & VOLF P. ITS 2 sequences heterogeneity in *Phlebotomus sergenti* Parrot, 1917 and *Phlebotomus similis*: possible consequence in their ability to transmit *Leishmania tropica*. *International Journal for Parasitology*, 2002, 32, 1123-1131.
- DEPAQUIT J., LÉGER N. & FERTÉ H. Le statut taxinomique de *Phlebotomus sergenti* Parrot, 1917, vecteur de *Leishmania tropica* (Wright, 1903) et *Phlebotomus similis* Perfliev, 1963 (Diptera-Psychodidae). Approches morphologique et morphométrique. Corollaires biogéographiques et épidémiologiques. *Bulletin de la Société de Pathologie Exotique*, 1998, 91, 346-352.
- GEBRE-MICHAEL T., BALKEW M., ALI A., LUDOVISI A. & GRAMICIA M. The isolation of *Leishmania tropica* and *L. aethiopia* from *Phlebotomus* (*Paraphlebotomus*) species (Diptera-Psychodidae) in the Awash Valley, northern Ethiopia. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 2004, 98, 64-70.
- GUILVARD E., RIOUX J. A., GALLEGRO M., PRATLONG F., MAHJOUR J., MARTINEZ-ORTEGA E., DEREURE J., SADDIKI A. & MARTINI A. *Leishmania tropica* au Maroc. III. Rôle vecteur de *Phlebotomus sergenti*. *Annales de Parasitologie Humaine et Comparée*, 1991, 66, 96-99.
- KILLICK-KENDRICK R. Phlebotomine vectors of the leishmaniasis: a review. *Medical and Veterinary Entomology*, 1990, 4, 1-24.
- KILLICK-KENDRICK R., KILLICK-KENDRICK M. & TANG Y. Anthroponotic cutaneous leishmaniasis in Kabul, Afghanistan: the high susceptibility of *Phlebotomus sergenti* to *Leishmania tropica*. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1995, 89, 477.
- LÉGER N., PESSON B., MADULO-LEBLOND G. & ABONNENC E. Sur la différenciation des femelles du sous-genre *Larroussius* Nitzulescu, 1931 (Diptera-Phlebotomidae) de la région méditerranéenne. *Annales de Parasitologie Humaine et Comparée*, 1983, 58, 611-623.
- MAROLI M., LAVAGNINO A., ANSALDI G. & CAVALLINI C. Indagine sui vettori di leishmaniosi (Diptera, Psychodidae) in tre differenti ambienti della Sicilia occidentale e in due delle isole Eolie. *Parassitologia*, 1990, 32, 305-311.
- MAROLI M., PAMPIGLIONE S. & TOSTI A. Cutaneous leishmaniasis in western Sicily (Italy) and preliminary survey of phlebotomine sandflies (Diptera: Psychodidae). *Parassitologia*, 1988, 30, 211-217.
- RIOUX J.A. Trente ans de coopération franco-marocaine sur les leishmanioses : dépistage des foyers. Facteurs de risque. Changements climatiques et dynamique noso-géographique. *Bulletin de l'Association des Anciens Élèves de l'Institut Pasteur*, 2001, 168, 90-101.
- THEODOR O. Psychodidae-Phlebotominae. *Die Fliegen der Palaearktischen Region*, 1958, 9c, 1-55.
- VOLF P., OZBEL Y., AKKAFI F., SVOBODOVA M., VOTYPKA J. & CHANG K.P. Sand flies (Diptera: Phlebotominae) in Saniurfa, Turkey: relationship of *Phlebotomus sergenti* with the epidemic of anthroponotic cutaneous leishmaniasis. *Journal of Medical Entomology*, 2002, 39, 12-15.

Reçu le 20 octobre 2003  
 Accepté le 16 avril 2004