

A REVIEW OF THE FLEA GENERA *HECTOPSYLLA* FRAUENFELD AND
RHYNCHOPSYLLUS HALLER (SIPHONAPTERA: PULICIDAE)

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Abstract.—*Rhynchopsyllus*, a monotypic genus, is proposed as a **new junior synonym** of *Hectopsylla*. A key for the 12 species of *Hectopsylla* is provided with annotation of host preferences and geographical distribution of *Hectopsylla pulex* (Haller).

Key Words: *Hectopsylla*, *Rhynchopsyllus*, Siphonaptera, Pulicidae, key

Rhynchopsyllus pulex described by Haller (1880) has been a source of taxonomic confusion. Schreiter and Shannon (1927) and Traub and Gammons (1950) erected *Maxilliopsylla lilloi* and *Rhynchopsyllus megastigmata*, respectively, from females only. Tipton and Méndez (1966) subsequently described the male of *R. megastigmata* from Panama (in the presence of accompanying females). Later Méndez (1977) reported associated males and females from Colombia to be the same as *R. megastigmata* from Panama, but considered them conspecific with *R. pulex*. Jordan (1939) synonymized *M. lilloi* with *R. pulex*. Jordan and Rothschild (1906), Dalla Torre (1924), and Pinto (1930) each reported the species as *Hectopsylla* (based only on females). In addition, Anduze et al. (1947) and Cova García and Tallaferro (1959) questioned the status of *Rhynchopsyllus* because of similarities with *Hectopsylla*. If one uses the characters described by Hopkins and Rothschild (1953), Panamanian and Colombian males reported by Tipton and Méndez (1966) and Méndez (1977) clearly belong to *Hectopsylla*. This paper provides observations to support synonymizing the mono-

typic genus *Rhynchopsyllus* with *Hectopsylla*.

Mammalian synonymies follow those of Wilson and Reeder (1993) and avian synonymies are those described in Peters (1934, 1940), Deignan et al. (1964) and Sibley and Monroe (1990). The depositories of material examined for this study are annotated after host/locality data as: The Natural History Museum, London (BMNH), Field Museum of Natural History, Chicago (FMNH), J.C. Beaucournu Collection (JCB), Museum d'Histoire Naturelle, Belgium (Md'HN), Michael W. Hastriter Collection (MWH), Robert E. Lewis Collection (REL), and National Museum of Natural History, Smithsonian Institution, Washington D.C. (USNM).

Genus *Hectopsylla* Frauenfeld

Hectopsylla Frauenfeld 1860: 464. Type species (by monotypy): *Hectopsylla psittaci* Frauenfeld.

Rhynchopsyllus Haller 1880: 72. Type species (by monotypy): *Rhynchopsyllus pulex* Haller. **New synonymy.**

Maxilliopsylla Schreiter and Shannon 1927: 6. Type species (by monotypy): *Maxil-*

liopsylla lilloi Schreiter and Shannon.
Synonymized by Jordan 1939: 303.

The diagnostic features distinguishing *Rhynchopsyllus* from *Hectopsylla* have been based only on females of the former. Jordan (1934) and Hopkins and Rothschild (1953) based separation of these two genera by the morphology of the spermatheca and maxilla. Jordan (1934) specifies the differences as "a long, narrow, pointed and curved maxilla and a conical projection at the orifice of the spermatheca" in *Rhynchopsyllus*, whereas the maxilla of *Hectopsylla* is "short and broadly triangular and the orifice of the spermatheca is flush with the surface, not projecting on a cone". More recent descriptions of the male of *R. pulex* by Tipton and Méndez (1966) and two additional species (*H. gracilis* Mahnert, 1982 and *H. pascuali* Beaucournu and Alcover, 1989) provide evidence that would suggest *Rhynchopsyllus* is synonymous with *Hectopsylla*. *Hectopsylla gracilis* and *H. pascuali* also have sharply pointed maxillae that are directed caudad. Both species clearly belong to *Hectopsylla*. Comparison of these three species illustrates the similarity of their maxillae (Figs. 19-21). *Rhynchopsyllus pulex* is the only species among the two genera, which bears a broad conical projection at the orifice of the duct of the spermatheca. Although the spermatheca is morphologically distinct from that of all species of *Hectopsylla* (except *H. stomis* to which it is quite similar) the authors consider the conical structure relevant as a species distinction only.

Both genera share a common sessile parasitic mode of life (primarily in the females). Modifications for a sessile mode of life shared by females of both genera include extreme serration and sometimes extreme elongation of the lacinia, angular frons, compression of thoracic segments, partial covering of the anterior portion of antennal fossa, and expansibility of intersegmental abdominal membranes (not truly neosomic). The expansibility of interseg-

mental abdominal membranes is demonstrated most dramatically among females of *R. pulex*, *H. knighti*, and *H. psittaci* (the only species within the two genera with preference for volant hosts). This is most extreme in *R. pulex* and is accompanied by autoseverance of appendages (a feature of species of *Tunga*). Evidence of autoseverance in *R. pulex* includes catabolic scarring of remaining coxae and trochanters, absent in all species of *Hectopsylla* examined.

Neither males of *Rhynchopsyllus*, nor *Hectopsylla* have developed adaptations to accommodate a sessile mode of life (shorter mouthparts, fewer serrations on lacinia, tendency for rounded frons, and inexpandible abdomens as demonstrated by examination of mounted male specimens of *Hectopsylla* previously attached to hosts). The feeding and copulatory behavior of *Rhynchopsyllus* or *Hectopsylla* males is virtually unknown. Their lack of abundance on hosts (none for *Rhynchopsyllus*) would suggest that feeding is minimal (if at all) and the occasional collection of male specimens of *Hectopsylla* from a host likely occurs while they are seeking females for mating.

The clasper of *Rhynchopsyllus* is closely allied with that of *Hectopsylla*, possessing a posteriorly projecting manubrium termed manubrium 2 by Hopkins and Rothschild (1953). The pattern of the aedeagus of *Rhynchopsyllus* is also similar to those of all species of *Hectopsylla*. The sclerotized inner tube (S.I.T.) is nearly identical, being extremely long and narrow with a small basal capsule to guide the short penis rod into the S.I.T. (Figs. 5-6, 8). Dorsal to the capsule and running obliquely parallel to the S.I.T. is a heavily sclerotized structure referred to as the crescent sclerite by Tipton and Méndez (1966) in their description of *R. pulex* males. This pair of sclerites is present in all *Hectopsylla* species, as well as *R. pulex*, but is not present in *Tunga*, or *Echidnophaga* (the most closely allied genera). Since the structure is dorsal and distinct from the defined capsule of the aedeagus (and not the roof of the capsule = cres-

³ Table 1. A summary of specimens examined during this study illustrating host preferences within the genus *Hectopsylla*.

Flea species	Chiropteran	Non-Chiropteran Mammal	Aves	Host Unknown
<i>H. brascae</i>	0	1/13 ¹	0	0
<i>H. coniger</i>	0	1/7	0	0
<i>H. cypha</i>	0	5/74	0	0
<i>H. eskeyi</i>	0	5/40	0	0
<i>H. gemina</i>	0	18/54	0	8/6
<i>H. gracilis</i>	0	2/9	0	0
<i>H. knighti</i>	0	0	0/1	0
<i>H. pascuali</i>	0	1/2	0	0
<i>H. psittaci</i>	0	0	5/61	0/5
<i>H. pulex</i>	0/34	0/3	0	3/3
<i>H. stomis</i>	0	7/55	0/5	0/4
<i>H. suarezi</i>	0	5/6	0	0/1

¹ 0/0 = number of males/number of females.

cent sclerite), it is not the crescent sclerite. These sclerites are herein referred to as the dorsal armature (D.A.) (Figs. 5–6). The apex of the D.A. of specimens of all species appears fused or at least contiguous with the S.I.T. (Fig. 6) (the position of the D.A. as illustrated in Fig. 5 is atypical of most specimens examined). Based on the common morphological features discussed, the authors consider the monotypic genus *Rhynchopsyllus* a junior synonym of *Hectopsylla*.

Hectopsylla pulex (Haller)
(Figs. 6–7, 19)

Rhynchopsyllus pulex Haller 1880: 72.

Rhynchopsylla pulex: Taschenberg 1880: 56.

Hectopsylla psittaci Baker 1904: 375, 434.

Hectopsylla pulex: Jordan and Rothschild 1906: 59, 63.

Rhynchopsyllus pulex: Cunha 1914: 172.

Hectopsylla pulex: Dalla Torre 1924: 20.

Maxilliopsylla lilloi Schreiter and Shannon 1927: 6 (type species of *Maxilliopsylla*, by monotypy).

Rhynchopsyllus pulex: Ewing 1929: 158.

Hectopsylla pulex: Pinto 1930: 332.

Rhynchopsyllus pulex: Jordan 1934: 19; Jordan 1939: 303 (synonymy of *M. lilloi*); Guimaraes 1940: 219; Fuller 1942:

44; Anduze et al. 1947: 1–10; Macchivello 1948: 15; Augustson and Ryan 1948: 111.

Rhynchopsyllus megastigmata Traub and Gammons 1950: 271; Hopkins and Rothschild 1953: 68.

Rhynchopsyllus pulex: Hopkins and Rothschild 1953: 66; Johnson 1957: 237; Barrera and Díaz-Ungría 1957: 174.

Hectopsylla pulex: Cova García and Tallaferró 1959: 331.

Rhynchopsyllus megastigmata: Tipton and Méndez 1966: 296.

Rhynchopsyllus pulex: Tamsitt and Fox 1970: 1093; Tipton and Machado-Allison 1972: 4; Méndez 1977: 164 (synonymy of *R. megastigmata*).

Material examined.—ARGENTINA: Buenos Aires, 1 ♀, Ex: *Nyctinomus brasiliensis* = *Tadarida brasiliensis* (I. Geoffroy) (BMNH). BOLIVIA: S. Cruz de la Sierra, 2 ♀, Ex: *Molossus obscurus* = *Molossus molossus* (Pallas) (BMNH); Magdalena, Dept. Beni, 2 ♀, Ex: *Eumops bonariensis* (Peters), 12 Nov 1966; Magdalena, Dept. Beni, 1 ♀, Ex: *Noctilio labialis* = *Noctilio albiventris* Desmarest, 20 Aug 1964 (USNM). BRAZIL: 1 ♀ (paratype), Ex: *Molossus* sp.; Lagõa Santa, 1 ♀, Ex: *Eumops perotis* (Schinz), 2 Feb 1916 (BMNH); Lagõa Santa, 2 ♀,

Ex: *E. perotis*, 2 Jan 1944 (USNM); Petropolis, 1 ♀, Ex: "ear of bat"; Paraná Prov., 3 ♀, Ex: *Histiopus velatus* (I. Geofrey) (BMHH). COLUMBIA: Ansermanuevo, Dept. Valle, 4 ♀, Ex: *M. molossus*, 20 Jul 1967; Cali, Dept. Valle, 2 ♀, Ex: *Molossus major* = *M. molossus*, 22 Nov 1962; Cali, Dept. Valle, 1 ♀, Ex: *M. molossus*, Jun 1967; Cartago, Dept. Valle, 2 ♀, Ex: *Molossus bondae* J.A. Allen, 10 Oct 1967 (USNM). ECUADOR: Albitigua, elev. 1,000 m, 3 ♀, Ex: *Rhipidomys leucodactylus* (Tschudi); Gualquiza, elev. 760 m, 1 ♀, Ex: "bat". PANAMA: Pacora, 2 ♂, Ex: "bat guano", 22 Jun 1961 and 27 Feb 1962 (USNM); Pacora, 1 ♂, 1 ♀, Ex: "bat guano", 20, 22 Jun 1961; Pacora, 2 ♀, Ex: "bat guano", 12, 14 Feb 1962; (MWH). PERU: Rio Chinchao, Dept. Huanuco, 1 ♀, Ex: *Molossus obscurus* = *M. molossus* (BMNH); Quince Mil, Cuzco Prov., 1 ♀, Ex: *T. brasiliensis*, 19 Jun 1950 (USNM). TRINIDAD: Santissima, 1 ♀, Ex: "bat", 27 Jul 1915 (USNM). UNITED STATES: Frio Cave, Uvalde County, Texas, 1 ♀, Ex: *Tadarida mexicana* = *T. brasiliensis*, 30 Mar 1955 (USNM). VENEZUELA: Esteban, Djiques, 2 ♀, Ex: *M. obscurus*; Merida, 1 ♀, Ex: *Vespertilio fuscus* = *Eptesicus fuscus* (Beauvois) (BMNH); 3 km S and 46 km W Caracas, Dto. Federal, 2 ♀, Ex: *M. obscurus* = *M. molossus*, 19, 20 Aug 1966 (USNM).

Remarks.—*Hectopsylla pulex*, one of 12 species of *Hectopsylla*, occurs primarily on bats of the family Molossidae and to a lesser extent on Vespertilionidae. The remaining species parasitize either Aves (*H. knighti*, *H. psittaci*) or non-Chiropteran mammals (Caviidae: *H. cypha*, *H. eskeyi*, *H. gemini*, *H. suarezi*; Muridae: *H. pascuali*, *H. gracilis*; Mustelidae: *H. broscus*, *H. coniger*; and Chinchillidae: *H. stomis*) (Table 1). The known country records of *Hectopsylla pulex*, its host species and host synonymies are listed in Table 2. The occurrence of a single female of *H. pulex* on *Zonotrichia pileata* =

Zonotrichia capensis (Müller) (reported in Cunha 1914) and three females examined from the Murid rodent *R. leucodactylus* are likely accidental associations.

Little is known about the life cycle of *H. pulex*. Females have been collected frequently on chiropteran hosts while males have been collected only from bat guano associated with species of *Molossus* in Colombia and Panamá.

KEY TO SPECIES OF *HECTOPSYLLA*

1. Maxilla rounded at apex (Fig. 11) (male unknown) *knighti*
- Maxilla broadly angular to sharply pointed at apex (Figs. 12–22) 2
2. Segment V of all tarsi with seven or eight (usually eight) lateral planter bristles; tarsal claws with a prominent basal tooth; metepimeron of female without a process on dorso-posterior margin of metepimeron *psittaci*
- Segment V of all tarsi with at most six pairs of lateral planter bristles; tarsal claws without a prominent basal tooth; metepimeron of female nearly always with a process at dorso-posterior margin (Fig. 2) (except *pulex*) ... 3
3. Male 4
- Female 13
4. P¹ of clasper narrower at apex than at base (Figs. 3, 7) 5
- P¹ of clasper broader at apex than at base (Fig. 4) 7
5. Tarsal segments V with six pairs of lateral planter bristles; median dorsal lobe of aedeagus absent or vestigial *broscus*
- Tarsal segments V with five or fewer pairs of lateral planter bristles on tarsi; median dorsal lobe well developed (Fig. 5) 6
6. P² and P³ of clasper pincer-like (Fig. 4); distal arm of st. IX divided into several lobes; fifth tarsal segments with four pairs of lateral planter bristles *stomis*
- P² and P³ not pincer-like (Fig. 7); distal arm of st. IX composed of a single lobe; fifth tarsal segments with five pairs of lateral planter bristles *pulex*
7. Median dorsal lobe of aedeagus poorly developed, at most discernible 8
- Median dorsal lobe well developed (Fig. 5), distinctly visible 9
8. Median lobe (L²) of distal portion of st. IX enlarged with concavity at ventral margin; apical margin of P¹ of clasper straight; P² not bifurcate apically *gracilis*
- Ventral margin of L² lacking concavity; apical

Table 2. Distribution and host-parasite relationships of *Hectopsylla pulex*.

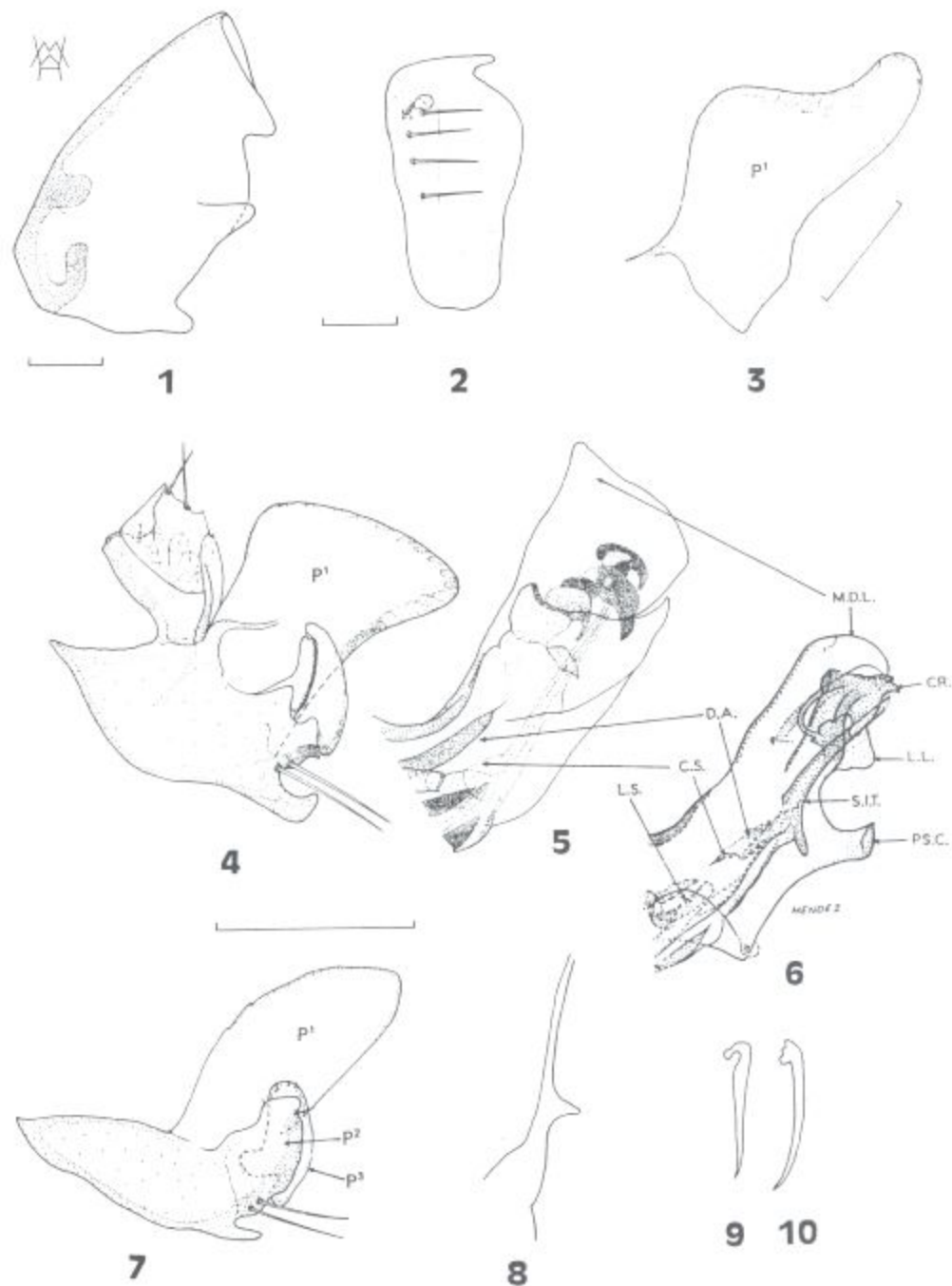
Country	Host species ¹	Flea sex
Argentina	<i>Myotis nigricans</i> (Schinz)	♀
	<i>Nyctinomus brasiliensis</i> = <i>Tadarida brasiliensis</i> (I. Geoffroy)	♀
	<i>Promops perotis</i> = <i>Eumops perotis</i> (Schinz)	♀
	<i>Zonotrichia pileata</i> = <i>Zonotrichia capensis</i> ² (Müller)	♀
Bolivia	<i>Eumops bonariensis</i> (Peters)	♀
	<i>Molossus obscurus</i> = <i>Molossus molossus</i> (Pallas)	♀
	<i>Noctilio labialis</i> = <i>Noctilio albiventris</i> Desmarest	♀
Brazil	<i>E. perotis</i>	♀
	<i>Histiotes velatus</i> = <i>Histiotes velatus</i> (II. Geoffroy)	♀
	<i>Molossus bondae</i> J. A. Allen	♀
	<i>Molossus obscurus</i> = <i>M. molossus</i>	♀
	<i>Molossus rufus</i> = <i>Molossus ater</i> E. Geoffroy	♀
	<i>Nyctinomus brasiliensis</i> = <i>T. brasiliensis</i>	♀
	<i>Nyctinomus macrotis</i> = <i>Nyctinomops macrotis</i> (Gray)	♀
Colombia	<i>Molossus bondae</i>	♀
	<i>Molossus major</i> = <i>M. molossus</i>	♀
	<i>Molossus molossus major</i> = <i>M. molossus</i>	♂/♀
	<i>M. molossus</i>	♂/♀
	<i>Molossus obscurus obscurus</i> = <i>M. molossus</i>	♀
	<i>Noctilio labialis</i> = <i>Noctilio albiventris</i>	♀
Ecuador	"Bat"	♀
	<i>Rhipidomys leucodactylus</i> ³ (Tschudi)	♀
México	<i>E. perotis</i>	♀
Panamá	<i>Tadarida yucatanica</i> = <i>Nyctinomops laticaudatus</i> (E. Geoffroy)	♂/♀
Perú	<i>Histiotes</i> sp.	♀
	<i>Molossus obscurus</i> = <i>M. molossus</i>	♀
	<i>Tadarida brasiliensis</i>	♀
Trinidad	"Bat"	♀
United States	<i>E. perotis</i>	♀
	<i>Tadarida mexicana</i> = <i>T. brasiliensis</i>	♀
Venezuela	<i>M. major</i> = <i>M. molossus</i>	♀
	<i>M. obscurus</i> = <i>M. molossus</i>	♀
	<i>Myotis nigricans</i>	♀
	<i>Vespertilio fuscus</i> = <i>Eptesicus fuscus</i> (Beauvois)	♀

¹ Host synonymy after Wilson and Reeder (1993).

² Only known record occurring on a bird.

³ Only known record occurring on a non-Chiropteran mammal.

- margin of P¹ somewhat convex; P² strongly bifurcated into two dentate projections *pascuali*
9. Dorsal-posterior margin of metepimeron with a caudally directed process (Fig. 2) *coniger*
- Dorsal-posterior margin of metepimeron entire, lacking process 10
10. Sclerotized inner tube (S.I.T.) with a sharp thorn-like spine at ventral midpoint (Fig. 8); apex of ventral lobe (L¹) of distal portion of st. IX pointed; fifth tarsal segments with three pairs of lateral plantar bristles (some with three and four on same metatarsus) *gemina*
- S.I.T. without thorn-like spine at ventral midpoint, if with tubercle or protuberance then rounded and blunt (Fig. 5); apex of L¹ rounded; fifth tarsal segments with either four or five pairs of lateral plantar bristles 11
11. L² with lateral patch of long thin setae; usually four pairs of lateral plantar bristles on fifth tarsal segments *cypha*
- L² without lateral patch of setae, but with vertical line of setae; four or five pairs of lateral plantar bristles on fifth tarsal segments 12
12. Fifth tarsal segments with four pairs of lateral plantar bristles *eskevi*
- Fifth tarsal segments with five pairs of lateral plantar bristles *suarezi*



Figs. 1-10. 1, Head, female *H. broscus*. 2, Metepimeron, *H. eskevi* (female paratype). 3, P¹ of clasper, *H. stomis*. 4, Clasper, *H. eskevi* (holotype). 5, terminal portion of aedeagus, *H. eskevi* (holotype). 6, Terminal portion of aedeagus, *H. pulex*. 7, Clasper, *H. pulex*. 8, Sclerotized inner tube, *H. gemina*. 9, Metatarsal claw, *H. pasquali* (allotype). 10, Metatarsal claw, *H. gracilis* (female paratype). Abbreviations: CR. = crochet; C.S. = crescent sclerite; D.A. = dorsal armature; L.L. = lateral lobe; L.S. = lateral sclerite; M.D.L. = medium dorsal lobe; P¹, P² and P³ = processes of clasper; P.S.C. = pseudocrochet; S.I.T. = sclerotized inner tube. Scale = 100 μ .

13. Metepimeron with a dorso-posterior projection (Fig. 2) 14
 - Metepimeron without a dorso-posterior projection *pulex*
14. Posterior margin of occiput with a well defined lobe (Fig. 1) 15
 - Posterior margin of occiput without a well defined lobe (though slightly indicated in *eskevi*) 16
15. Tergum II with three setae per side and t. VII with two or three setae per side; frons with convex angle midway between oral angle and internal incassation (Fig. 1); five or six (usually six) lateral plantar bristles on fifth tarsal segments *brosicus*
 - Tergum II with one or two setae per side and t. VII with one per side; frons with angular projection immediately below internal incassation; three lateral plantar bristles on fifth tarsal segments *coniger*
16. Sclerotized rim of sensillial plate anterior to sensillial pits greater than twice width of double row of pits *stomis*
 - Sclerotized rim of sensillian plate anterior to sensillial pits at most as wide as double row of pits 17
17. Fifth tarsal segments with three pairs of lateral plantar bristles; ventral apical margin of t. VIII with tooth-like projection *gemina*
 - Fifth tarsal segments with either four or five pairs of lateral plantar bristles; ventral apical margin of t. VIII without tooth-like projection 18
18. Fifth tarsal segments with five pairs of lateral plantar bristles (occasional specimens may have four and five on the same tarsus) *suarezi*
 - Fifth tarsal segments with four pairs of lateral plantar bristles 19
19. Dorsal margin of metepimeron heavily sclerotized, sclerotization extending to apex of process which is markedly turned down; usually three setae on metepimeron *cypha*
 - Dorsal margin of metepimeron not noticeably sclerotized (Fig. 2); usually four setae on metepimeron 20
20. Hilla of spermatheca nearly as wide throughout as width of bulga; duct of spermatheca connecting at cribriform area of bulga on ventral margin *eskevi*
 - Hilla of spermatheca much narrower than width of bulga, with marked narrowing from base of bulga to apex of hilla; duct of spermatheca connecting at cribriform area of bulga on ventral apical margin 21
21. Base of metatarsal claw with small cleft, or sinus (Fig. 9) *pasquali*

- Base of metatarsal claw without cleft, or sinus (Fig. 10) *gracilis*

OTHER MATERIAL EXAMINED

Hectopsylla broscus Jordan and Rothschild 1906
(Fig. 12)

Material examined.—ARGENTINA: Central Pampa, 1 ♀ (lectotype), Ex: *Conepatus humboldtii* Gray; Central Pampa, 5 ♀ (paralectotypes), Ex: *C. humboldtii*; San Rafael, Mendoza Prov., 1 ♂, 1 ♀, Ex: *Conepatus suffocans* = *C. chinga* (Molina); Don Roberto, San Luis Prov., 1 ♀, Ex: *Conepatus chinque* = *C. chinga*, 14 Jun 1962; "Southern Argentina," 5 ♀, Ex: *Zaedyus pichiy* (Desmarest), 30 Jun 1962 (BMNH).

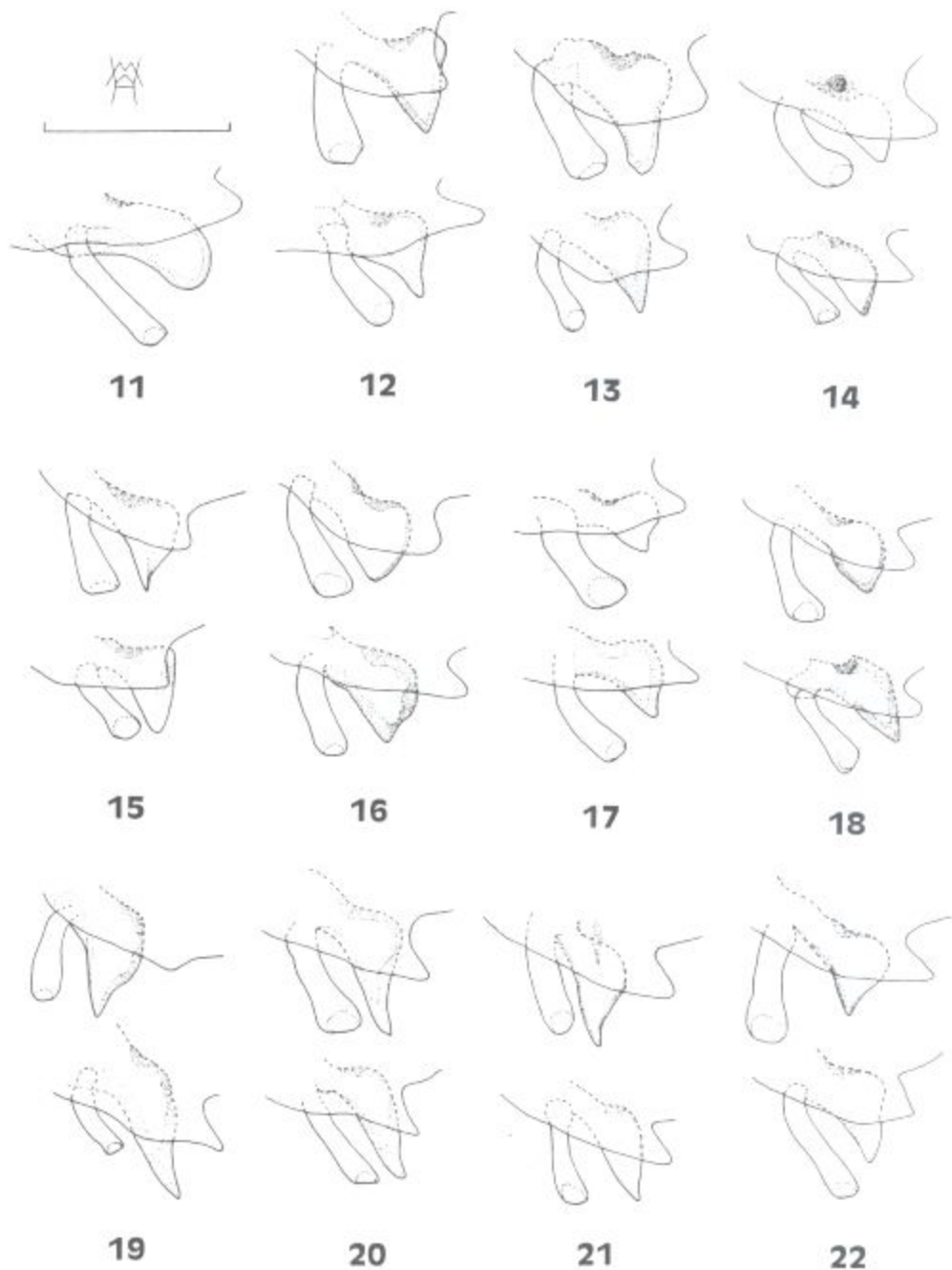
Remarks.—All records of this species are restricted to Argentina and skunks of the genus *Conepatus* appear to be the preferred host.

Hectopsylla coniger Jordan and Rothschild 1906
(Fig. 17)

Material examined.—BOLIVA: Pampa Olliga, 1 ♂ (lectotype), Ex: *Conepatus arequipae* = *C. chinga*, 19 Oct 1901; Pampa Olliga, 1 ♀ (lectoallotype), 6 ♀ (paralectotypes), Ex: *C. chinga*, 19 Oct 1901 (BMNH).

Hectopsylla cypha Jordan 1942
(Fig. 14)

Material examined.—ARGENTINA: Las Catitas, Mendoza Prov., 9 ♀ (paratypes), Ex: *Octomys barrerae* = *Tympanoctomys barrerae* (Lawrence), Jul 1939; Mendoza, 1 ♀, Ex: *Microcavia australis* (I. Geoffroy and d'Orbigny), 6 Aug 1959; Puesto "La Carpa," Mendoza, 5 ♀, Ex: *Graomys griseoflavus griseoflavus* = *Graomys griseoflavus* (Waterhouse), 12, 14 Jul 1959; Puesto "La Carpa," Mendoza, 2 ♀, Ex: *M. australis*, 13, 15 Jul 1959; San Rafael, Mendoza Prov., 1 ♀ (neoallotype), 2 ♂, 52 ♀ (paratypes), Ex: *M. australis*, Apr–Jul 1939; Santa Rosa, Mendoza Prov., 2 ♂, 4 ♀ (paratypes), Ex: *M. australis*, Jul 1939



Figs. 11-22. First segment of maxillary palpus, maxilla, and ventral margin of head (genal lobe); male is positioned directly above female for each species. 11, *H. knighti* (female holotype). 12, *H. broscus* (female lectotype). 13, *H. stomis* (female holotype). 14, *H. cypha* (paratypes). 15, *H. gemina*. 16, *H. suarezi*. 17, *H. coniger* (lectotype and allotype). 18, *H. eskeyi* (holotype and paratype). 19, *H. pulex*. 20, *H. pascuali* (holotype and paratype). 21, *H. gracilis* (holotype and paratype). 22, *H. psittaci*. Scale = 100 μ .

(BMNH). Zapallar, La Rioja Prov., 1 ♂, Ex: "Viscacha" *Lagostomus* sp. Brookes, 8 Jan 1933 (USNM).

Remarks.—Mountain cavies (*M. australis*), which are restricted to Argentina and southern Chile, are the preferred host for this flea. The geographic distribution of *T. barrerae* is also restricted to Argentina and it is rarely collected. *Hectopsylla cypha* occurring on other hosts that have much broader geographical distributions (*Lagostomus* sp. and *G. griseoflavus*) are likely accidental associations.

Hectopsylla eskeyi Jordan 1933

(Figs. 2, 4–5, 18)

Material examined.—BOLIVIA: Pucará, elev. 2,400 m, 1 ♀, Ex: *G. griseoflavus*, 28 Sep 1954; Samaipata, Dept. Santa Cruz, elev. 1,650 m, 1 ♀, Ex: *G. griseoflavus*, 28 Jan 1955; Serrano, Dept. Chuquisaca, elev. 2,160 m, 1 ♀, Ex: *Hesperomys muriculus* = *Calomys callosus* (Rengger), 24 Jul 1955 (BMNH). ECUADOR: Riobamba, Chimborazo Prov., elev. 2,800 m, 1 ♀, Ex: *Rattus rattus* (Linn.), 12 Jun 1956; Sanjapamba, Tungurahua Prov., 6 ♀, Ex: *Cavia porcellus* (Linn.), 1956 (BNMH). PERU: Huancabamba, elev. 1,960 m, 4 ♂, 9 ♀, Ex: *Cavia cobaya* (domestic) = *C. porcellus*, 17, 19 May 1956; Lima, 1 ♂ (holotype), 1 ♀ (Neoallotype), 1 ♂, 18 ♀ (paratypes), Ex: "rats," 1930; Yura, Arequipa Prov., elev. 8,200 ft, 1 ♀, Ex: *Cavia musteloides* = *Galea musteloides* Meyen, 8 Aug 1939 (BMNH); Yura, Arequipa Prov., elev. 8,200 ft, 1 ♀, Ex: *G. musteloides* (REL).

Remarks.—*Hectopsylla eskeyi* occurs in the higher Andean valleys on a variety of hosts and little can be said of its host specificity.

Hectopsylla gemina Jordan 1939

(Figs. 8, 15)

Material examined.—ARGENTINA: Mendoza, 1 ♂, 4 ♀, Ex: *M. australis*, 9 Aug 1959; Las Catitas, Mendoza Prov., 1 ♂, 1 ♀, Ex: *Octomys barrerae* = *T. barrerae*; La Paz, Mendoza Prov., 3 ♂, 23 ♀, Ex: *M.*

australis, Feb-Mar 1939; Puesto "La Carpa," Mendoza Prov., elev. 600 m, 1 ♂, 6 ♀, Ex: *M. australis*, 13–17 Jul 1959; Puesto "Pugin," Algarrobito, Mendoza Prov., 620 m, 4 ♂, 7 ♀, Ex: *M. australis*, 24–31 Jul 1959; San Rafael, Mendoza Prov., 8 ♂, 6 ♀, Mar–May 1939; Santa Rosa, Mendoza Prov., 6 ♂, 7 ♀ (paratypes), Ex: *M. australis*, Jul & Feb 1939; Fortin Uno, Rio Negro Prov., 1 ♂ (holotype), 1 ♀ (paratype), Ex: *M. australis*, Aug 1937; near General Roca, Rio Negro Valley, Rio Negro Prov., 1 ♂, 2 ♀, Ex: *Ctenomys* sp. Blainville, 25 Mar 1952 (BMNH). Nacunan, Mendoza Prov., 1 ♀, Ex: *Akodon* sp. Meyen, 15 Mar 1983 (REL). General Acha, La Pampa Prov., 1 ♂, Ex: *M. a. australis*, 20 May 1936; La Cristina, 1 ♀, Ex: *Galea* sp. Meyen, 26 Oct 1966 (USNM).

Remarks.—All records of this species are restricted to Argentina, the preferred host being mountain cavies (*M. australis*). Although this flea has not been associated with *H. cypha*, it parasitizes the same host species in the same general geographic region.

Hectopsylla gracilis Mahnert 1982

(Figs. 10, 21)

Material examined.—ARGENTINA: Puesto "La Carpa," Mendoza Prov., elev. 600 m, 1 ♀, Ex: *Canis familiaris* Linn., 17 Jul 1959; Puesto "La Carpa," Mendoza Prov., elev. 600 m, 6 ♀, Ex: *G. griseoflavus* ssp., 14 Jul 1959 (BMNH). Puerto Madryn, Chubut Prov., 1 ♂ (holotype), Ex: *Eligmodontia morgani* Allen, 23 Apr 1978; Puerto Madryn, Chubut Prov., 1 ♂, 1 ♀ (paratypes), Ex: *E. morgani*, 5 Apr 1978 (Md'HN); Puerto Madryn, Chubut Prov., 1 ♀, Ex: *E. morgani*, 24 Apr 1978 (REL).

Remarks.—Specimens from Mendoza Province (BMNH) were not recognized as a *H. gracilis* until Mahnert's description in 1982. The geographic range of the preferred host, *E. morgani*, is limited to Argentina and adjacent southern Chile (Wilson and Reeder 1993).

Hectopsylla knighti Traub and Gammons
1950
(Fig. 11)

Material examined.—México Michoacán State, Municipality of Tancitaro, Tancitami, 1 ♀ (holotype), Ex: "head of swift," May 1940 (FMNH).

Remarks.—Additional observations of "swifts" in the region of Michoacán, México, are needed to find the males of this species and further elucidate its taxonomic status.

Hectopsylla pascuali Beaucournu and
Alcover 1990
(Figs. 9, 20)

Material examined.—ARGENTINA: Rio Chapelco, Neuquén Province, 1 ♂ (holotype), 1 ♀ (allotype), 1 ♀ (paratype), Ex: *Chelemys macronyx* (Thomas), 9 Dec 1987 (JCB).

Hectopsylla psittaci Frauenfeld 1860
(Fig. 22)

Material examined.—ARGENTINA: 1 ♀ (lectotype), 2 ♀ (paralectotypes), Ex: *Strix pelate* = *Tyto alba* (Scopoli); Buenos Aires, 2 ♀, Ex: "owl," 1913; Chivilcoy, Buenos Aires Province, 2 ♀, Ex: "hen," 2 Feb 1936 (BMNH); Las Rosas, (B.A.), 1 ♀, Ex: "Paloma"; Zapallar, La Rioja Prov., 3 ♀, Oct 1933 (USNM). BRAZIL: Progne, Rio de Janeiro State, 2 ♀ (USNM). CHILE: St. Jogo (Santiago de Chile), 2 ♀ (syntypes), Ex: *Cyarzolyiscus patagonius* or *Enicognathus leptorhynchus* (King) (BMNH); Santiago, 1 ♀, 11 Sep 1951; Santiago, 2 ♀, Ex: "turtle dove" (USNM). HOLLAND: den Haag, 22 ♀, Ex: *Phasianus* sp. (L.), Aug 1926; Rotterdam, 4 ♀, Ex: *Gallus domesticus* = *Gallus gallus* (L.), July 1936 (BMNH); den Haag, 3 ♀, Ex: *Phasianus* sp., Aug 1926 (USNM). ENGLAND: London (Zoological Gardens), 3 ♀, Ex: *Cittocincla macrura* (sic) = *Copsychus malabaricus* (Swinhoe); London (Zoological Gardens), 3 ♂, Ex: "birds in western aviary"; London (Zoological Gardens) 3 ♀,

Ex: *Cittocincla macrura* (sic) or *Copsychus saularis* (L.) (BMNH); London (Zoological Gardens), 2 ♀, Ex: "*Cittocincla* (sic) = *Kitto-cincla* (Gould) or *Copsychus*" (USNM). PERU: E. Ribeyro, Lima, 1 ♂, 2 ♀, Ex: "chickens"; Hacienda Las Vegas, 30 km from Barranca City, 1 ♀, Ex: swallow "variety called Santa Rosita," 1947 (BMNH); Cuzcon, Ocongata River, elev. 3,500–4,000 m, 2 ♀, Ex: *Merganetta leucogenis turneri* = *Merganetta armata* Gould, 26 Jul 1949; Hacienda Ceapano, Ocongata, Cuzco Prov., 1 ♀, Ex: *Colaptes rupicola puna* = *Colaptes rupicola* d'Orbigny, 14 Aug 1950 (USNM). UNITED STATES: Oceanside, San Diego County, California, 1 ♀, Ex: *Bubo virginianus pacificus* = *Bubo virginianus* (Gmelin), 7 Jun 1942 (BMNH); Oceanside, San Diego County, California, 1 ♀, Ex: *B. v. pacificus*, 7 Apr 1942 (USNM); Alameda (6.5 km w. Newark), California, 1 ♂, 4 ♀, Ex: cliff swallow nests, 15 Jan 1981 (REL).

Remarks.—*Hectopsylla psittaci*, a primary parasite of birds, is recorded from diverse areas. However, it is native to the southern cone of South America with populations dispersed to the southwestern United States by owls and other migratory bird species. Schwan et al. (1983) reported large numbers of this species from the nests of Cliff Swallows (*Hirundo pyrrhonota* Vieillot) and Black Phoebe (*Sayornis nigricans* (Swainson)) in southern California. The species likely occurs through Central America as well.

Hectopsylla stomis Jordan 1925
(Figs. 3, 13)

Material examined.—ARGENTINA: Mariano, Buenos Aires Prov., 1 ♀ (holotype), Ex: "bird", Dec 1912; Cañada Mariano, Buenos Aires Prov., 4 ♀ (paratypes), Ex: "birds," 30 Dec 1912; Bahía Blanca, Buenos Aires Prov., 19 ♀ (paratypes), Ex: *Mephitis* sp. E. Geoffroy and G. Cuvier (sic), only *Conepatus* spp. Gray occur in Argentina, 15 Jan 1911; Pique, Buenos Aires, 1 ♂, 4 ♀, Ex: *Lagostomus maximus*

(Desmarest), 5 May 1928; El Quebrachal, Salta Prov., elev. 620 m, 2 ♀, Ex: *L. maximus*, 30 Jul 1940; El Ojito, Santiago del Estero Prov., elev. 620 m, 1 ♀, Ex: *L. maximus*, 19 Jul 1940; La Paz, Mendoza Prov., elev. 620 m, 6 ♂, 22 ♀, Ex: *L. maximus*, 1 Mar 1939; Puesta "pugin" Algarrobito, Mendoza Prov., elev. 620 m, 4 ♀, Ex: *L. maximus*, 25 Jul 1959; San Rafael, Mendoza Prov., 1 ♀, Ex: *M. australis*, 20 Apr 1939 (BMNH). Chasicó, Buenos Aires Prov., 1 ♀, Ex: *L. m. maximus*, May 1968; Patagonia, 4 ♀, Ex: "Viscacha" *Lagostomus* sp., Sep 1962; Victoria, La Pampa Prov., 1 ♀, Ex: *Rattus* sp., 29 Jun 1935 (USNM).

Remarks.—*Lagostomus maximus*, occurring in southern Paraguay, and in northern and central Argentina is the primary host for this flea. *Hectopsylla stomis* has been collected throughout the year.

Hectopsylla suarezi C. Fox 1929
(Fig. 16)

Material examined.—ECUADOR: Guamoto, Chimborazo Prov., 1 ♂, Ex: "guinea pig"; Guamoto, Chimborazo Prov., 1 ♀, Ex: "guinea pig," 8 Aug 1927. PERÚ: near Hauncabamba, Dept. Piura, 4 ♂, 4 ♀, Ex: *Cavia aperia* Erxleben (domesticated), 1946/47; near Hauncabamba, Dept. Piura, 1 ♀, Ex: "among human clothes" (BMNH). Near Hauncabamba, Dept. Piura, 1 ♀ (USNM).

Remarks.—This flea is associated with domestic guinea pigs associated with human habitations. Astute collecting may yield many more specimens than are currently known, although the wide use of DDT in human dwellings for controlling the vectors of Chagas' disease (conenose bugs) and malaria (mosquitoes) may explain the absence of these fleas in collections after the mid-1940s.

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LITERATURE CITED

- Anduze, P. J., Vogelsang, E. G., and C. F. Pifano. 1947. Nómima de artrópodos vulnerantes actualmente conocidos en Venezuela. Boletín de Entomología Venezolana, (núm. extraord.): 1-10.
- Augustson, G. F. and L. C. Ryan. 1948. The flea genus *Rhynchopsyllus* in the United States (Siphonaptera). Bulletin, Southern California Academy of Science 47(3): 111-112.
- Baker, C. F. 1904. A revision of American Siphonaptera, or fleas, together with a complete list and bibliography of the group. Proceedings of the United States National Museum 27(1361): 365-469.
- Barrera, A. and C. Diaz-Ungria. 1957. Sifonápteros de Venezuela, consideraciones generales, catalogo anotado y claves, con exposicion grafica de los caracteres en ellas utilizados (Insecta: Siphonaptera). Memoria de la Sociedad de Ciencias naturales la Salle, pp. 160-173.
- Cova García, P. and E. Tallaferro. 1959. Pulgas más comunes de Venezuela. Archivos Venezolanos de Patología Tropical y Parasitología Médica 3: 327-348.
- Cunha, A. 1914. Contribuição para o estudo dos Siphonapteros do Brasil. Rio de Janeiro, Rodrigues et Cia. 212 pp.
- Dalla Torre, C. G. 1924. Aphaniptera. Sonderabdruck aus den berichten des naturwissenschaftlich-medizinischen Vereines in Innsbruck 39: 1-28.
- Deignan, H. G., R. A. Paynter, Jr., and S. D. Ripley. 1964. Check-list of birds of the world, a continuation of the work of James L. Peters, Vol. X. In Mayr, E. and R. A. Paynter, Jr., eds., Museum of Comparative Zoology. Cambridge, Massachusetts, 502 pp.
- Ewing, H. E. 1929. A Manual of External Parasites. Charles C. Thomas, Publisher. Baltimore, Maryland, 225 pp.
- Frauenfeld, G. R. von. 1860. *Hectopsylla psinaci* n. gen., n. sp. Sitzungsberichte der Akademie der Wissenschaften. Mathematische-Naturwissenschaftliche Classe Wein 40: 462-465.
- Fuller, H. S. 1942. Notes on Neotropical Siphonaptera. Revista Entomologica 13(1-2): 39-44.
- Guimarães, L. R. 1940. Notas sobre Siphonaptera e redescricao de *Poligenis occidentalis* (Almeida

- Cunha, 1914). *Archivos de Zoologia do Estado de São Paulo* 2: 216-50.
- Haller, G. 1880. *Rhynchopsyllus*, eine neu Puliciden-Gattung, in einigen Worten gekennzeichnet. *Archiv für Naturgeschichte* 46(1): 72-87.
- Hopkins, G. H. E. and M. Rothschild. 1953. An illustrated catalogue of the Rothschild collection of fleas (Siphonaptera) in the British Museum (Nat. Hist.), Vol. I. Tungidae and Pulicidae. British Museum (Natural History), 361 pp.
- Johnson, P. T. 1957. A classification of the Siphonaptera of South America with descriptions of new species. *Memoirs of the Entomological Society of Washington*, No. 5, 298 pp.
- Jordan, K. 1934. On some Siphonaptera from Argentina. *Revista Sociedad Entomologica Argentina* 6(1): 19-21.
- . 1939. On five new Siphonaptera from the Republic of Argentina. *Novitates Zoologicae* 41: 292-303.
- Jordan, K. and N. C. Rothschild. 1906. A revision of the Sarcopsyllidae, a family of Siphonaptera. *Thompson, Yates and Johnston Laboratories Report (new series)* 7: 15-72.
- Macchiavello, A. 1948. Siphonaptera de la costa sur-occidental de America (primera lista y distribución zoo-geográfica). *Oficina Sanitaria Panamericana Publication* 237, pp. 1-49.
- Méndez, E. 1977. Mammalian-Siphonapteran associations, the environment and biogeography of mammals of southwestern Colombia. *Questiones Entomologicae*, 13(2): 91-182.
- Peters, J. L. 1934. *Check-list of Birds of the World*, Vol. II, Harvard University Press, Cambridge, Massachusetts, 401 pp.
- . 1940. *Check-list of Birds of the World*, Vol. IV, Harvard University Press, Cambridge, Massachusetts, 291 pp.
- Pinto, C. 1930. Artrópodos parasitos e transmissores de doenças. Chapter 10, Siphonapteros, pp. 281-395. *In Tratado de Parasitologia*, 4, Pimento de Mello and Cia, Rio de Janeiro, 845 pp.
- Schreiter, R. and R. C. Shannon. 1927. Un nuevo e interesante género y especie de una pulga del murciélago. *Boletín Museo de Historia Natural, Universidad de Tucumán* 1(12): 1-15.
- Schwan, T. G., M. L. Higgins, and B. C. Nelson. 1983. *Hectopsylla psittaci*, a South American sticktight flea (Siphonaptera: Pulicidae), established in cliff swallow nests in California, USA. *Journal of Medical Entomology* 20(6): 690-92.
- Sibley, C. G. and B. L. Monroe, Jr. 1990. *Distribution and taxonomy of birds of the world*. Yale University Press, New Haven and London, 1,111 pp.
- Tarnsitt, J. R. and I. Fox. 1970. Records of bat ectoparasites from the Caribbean region (Siphonaptera, Acarina, Diptera). *Canadian Journal of Zoology* 48(5): 1093-1097.
- Taschenberg, O. 1880. Die Flöhe. Die arten derinsectenordnung Suctoria nach ihrem chitinskelet monographisch dargestellt, 122 pp.
- Tipton, V. J. and C. E. Machado-Allison. 1972. Fleas of Venezuela. *Brigham Young University Science Bulletin (Biological Series)* 42(6): 1-115.
- Tipton, V. J. and E. Méndez. 1966. The fleas (Siphonaptera) of Panamá, pp. 289-385, plates 47-93. *In* Wenzel, R. L. and V. J. Tipton, eds., *Ectoparasites of Panamá*, Field Museum of Natural History, Chicago, 861 pp.
- Traub, R. and J. G. Gammons. 1950. Two new fleas of the family Tungidae. *Journal of Parasitology* 36(3): 1-4.
- Wilson, D. E. and D. M. Reeder. 1993. *Mammal Species of the World*, a Taxonomic and Geographic Reference, 2nd ed. Smithsonian Institution Press, Washington, 1,206 pp.