LICE SPECIES (INSECTA:PHTHIRAPTERA) FROM CHILEAN PICIDAE (AVES: PICIFORMES)[1]

Daniel González-Acuña,[2] Karen Ardiles,[2] Lucila Moreno,[3] Sebastián Muñoz,[2] Rodrigo A. Vásquez,[4] Cristian Celis,[4] Ricardo Rozzi,[4,5] and Armando C. Cicchino[6]

ABSTRACT: Four lice species (Phthiraptera: Philopteridae, Menoponidae) were collected from three woodpecker species (Aves: Picidae) in central and southern Chile. We collected *Penenirmus campephili* Eichler and *Menacanthus campephili* Price & Emerson from Magellanic woodpecker (*Campephilus magellanicus,* King); *Menacanthus pici* (Denny) and *Penenirmus auritus* (Scopoli) from the Chilean flicker (*Colaptes pitius* Molina) and *M. pici* as a parasite from a Striped woodpecker (*Veniliornis lignarius* Molina). The species *P. auritus* and *M. campephili* are new lice records for Chile. The description of both *P. auritus* and *M. pici* parasitizing the Chilean flicker and Striped woodpecker respectively, are new host-parasite associations.

INTRODUCTION

Studies concerning lice parasitic on birds of the family Picidae collected in Chile or adjacent territories of neighboring countries are scarce. In 1953, Eichler described the new species *Penenirmus campephili* (Philopteridae) on a Magellanic woodpecker (*Campephilus magellanicus*, King 1827) from the locality of Loncoche (Chile). Later, Price and Emerson (1975) described *Menacanthus campephili* (Menoponidae) on the same host from Isla de los Estados (Tierra del Fuego Province, southeastern Argentina). In addition, *Menacanthus pici* described by Denny (1842) and *Penenirmus jungens* by Kellogg (1896) are reported parasitizing the Chilean flicker (*Colaptes pitius* Molina 1972) and the Andean flicker (*Colaptes rupicola* d'Orbingy1840) by Price et al. (2003), unfortunately without indication of localities for both records. Carriker (1967) published posthumously a new louse species from *Colaptes pitius* from Valparaíso, Chile, as *Menacanthus pitius*, however it was later sunk in synonymy under *Menacanthus pici* by Price and Emerson (1975).

Because of this paucity, it is our aim to show the findings of a survey of lice carried out on three out of the four known woodpeckers found in Chile (Martínez and González, 2004), giving the status of knowledge, summary description, prevalence and host or hosts known for each one of the four louse species recorded.

---

[1] Received on Jaunary 16, 2013. Accepted on April 15, 2013.

[2] Facultad de Ciencias Veterinarias, Universidad de Concepción, Casilla 537, Chillán, Chile. danigonz@udec.cl

[3] Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Concepción, Chile.

[4] Instituto de Ecología y Biodiversidad, Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Casilla 653, Santiago, Chile.

[5] University of North Texas, Department of Philosophy & Religion Studies, Denton, TX 76203 USA; Parque Etnobotánico Omora, Universidad de Magallanes, Punta Arenas, Chile

[6] Universidad de Mar del Plata, Castelli 4117, 7600 Mar del Plata, Argentina.

Mailed on September 25, 2014

MATERIALS AND METHODS

We used the nomenclature established by Dickinson (2003). For this study we analyzed bird specimens from three sources: a) preserved skins housed at the collection of the National Museum of Natural History (Santiago, Chile), b) dead birds found in the fields and roads, and c) birds captured with mist-nets (Table 1). In the latter case, each netted bird was immediately wrapped with an absorbent paper, put in individual plastic bags containing ca. 2 cm^3 ethyl acetate in order to kill lice *in situ*, and then frozen as soon as possible. In the laboratory each bird was carefully searched for lice by a feather-by-feather procedure. Location of individual lice in particular pteryla or apteria was mapped in pre-printed cards, paying special attention to the sites of oviposition.

Collected lice were stored in 70% alcohol and then prepared in Canada balsam (see Price et al., 2003). Eggs were cleared with Amman lactophenol, mounted and observed in this medium. Drawings were made by one of us (ACC) using a camera lucida attached to a Wild M-20 microscope. All measurements were taken from mounted specimens by means of a calibrated eyepiece, all expressed in millimeters and identified by the following abbreviations: HL head length, POW preantennal width, OW maximum width of the head, PL prothorax length, PW prothorax width, PTW pterothorax width, AL abdominal length, AW maximum width of the abdomen, TL total body length.

RESULTS AND DISCUSSION

We collected a total of 51 lice representing four species on twelve specimens belonging to three species of woodpeckers. Details of positive hosts, locality and quantity of lice species per host are indicated on Table 1. The status of knowledge, summary descriptions, prevalence and host or hosts known for each species are briefly commented on below.

Penenirmus auritus (Scopoli, 1763)

(Figs. 1-11)

Male and *female* as in Figs. 1 and 2, respectively. Anterior dorsal plates showing intense variation even within the same individual host population (Figs. 4-5 show the extreme variation found in 55 specimens from Argentina). Pterothoracic posterior marginal setae typically with 3+2 each side. Tergites III-VI with 4-5 posterior setae. Sternites III-VI with 2 (less frequently 3) setae. Male genitalia as in Fig. 3, little distinctive in spite of their variation in size concomitant with the body size of adult males. Measurements: body dimensions of the only male recorded from *C. pitius* in Chile are shown in Table 2.

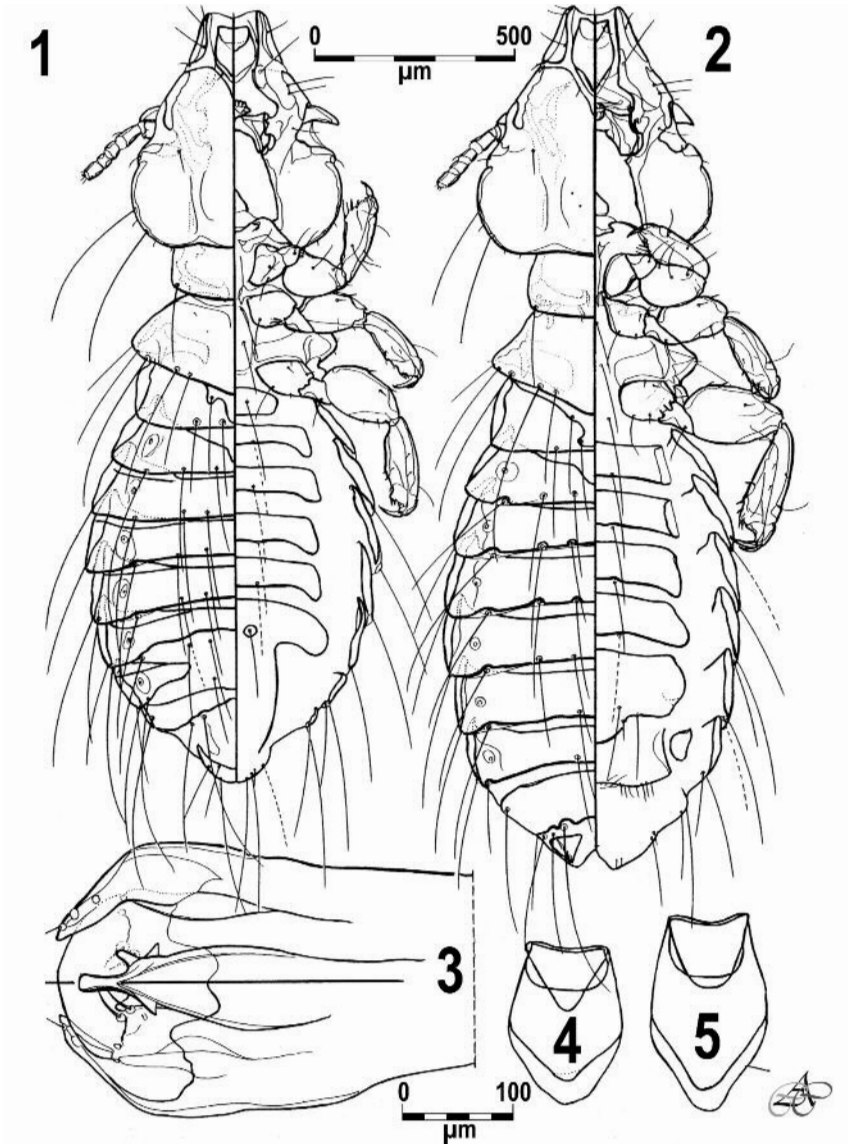
Preimaginal instars: as has been pointed out by Castro et al. (1988: 6), the alleged egg of *Menacanthus pici* described by Castro and Cicchino (1978: 80 fig. 12) belongs to *P. auritus*, and because features of nymphal instars are not known for this species or for any other in the genus, they are described and illustrated below.

First nymphal instar: general habitus as in Fig. 6. Pterothorax with one thoracic marginal seta each side. Abdomen lacking tergal and paratergal plates, as is the rule for most Philopteridae (see Mey, 1994). Tergal setae: II-VIII 1+1. Measurements (n = 2): HL 0.338-0.345, OW 0.324-0.330, TL 0.919-1.000.

Table 1. Lice collected from birds of the family Picidae in Chile, with indications of host, sex, number of individuals recorded and locality of collection.

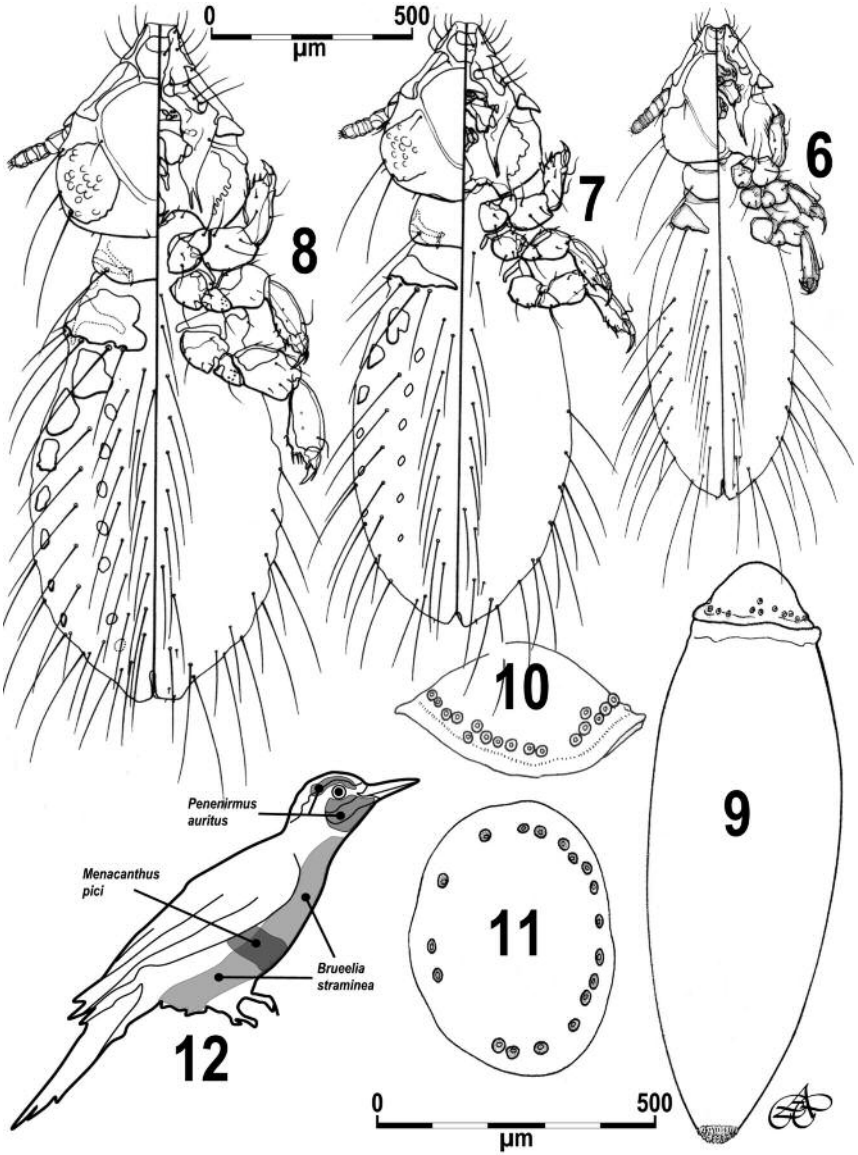
Host species	Louse species	Host precedence	Lice quantity by sex			Total
			Male	Female	Nymph	
Campephilus magellanicus	*Penenirmus campephili*	Chillán*	_	1	_	1
		Lago Ranco*	_	_	4	4
		Navarino	3	6	3	12
	Menacanthus campephili	Los Maitenes	1	_	_	1
		Curacautín*	_	_	1	1
		Lonquimay	2	_	1	3
Colaptes pitius	*Penenirmus auritus*	Coyhaique*	1			1
	Menacanthus pici	Molina*	3	1	1	5
Veniliornis lignarius	*Menacanthus pici*	Las Chinchillas	5	7	14	26
Total			13	15	23	51

*Indicates materials collected from study skins of birds housed at Museo Nacional de Historia Natural de Chile.



Figs. 1-5. *Penenirmus auritus* (Scopoli, 1763). 1 male, 2 female, 3 male genitalia, 4-5 extremes of variation of anterior dorsal plates in 55 individuals from *Colaptes campestroides* (Malherbe) from Buenos Aires Province, Argentina.

Second nymphal instar: general habitus as in Fig. 7. Pterothoracic marginal setae typically 2+2 each side. Abdomen with discrete paratergites in II-VII, but much less marked in V-VII. Rounded small hemitergites discernible on III-VIII, faintly marked. Tergal setae: II-VIII 1+1. Measurements (n = 5): HL 0.459-473, OW 0.378-0.446, TL 1.378-1.554.



Figs. 6-11. *Penenirmus auritus* (Scopoli, 1763). 6 first nymphal instar (N I), 7 second nymphal instar (N II), 8 third nymphal instar (N III), 9 egg in lateral view, 10-11 operculum in lateral and polar views, respectively, 12 body areas of oviposition on the three lice species found in *Colaptes campestroides* (Malherbe) from Buenos Aires Province, Argentina (see more explanations in the text).

Third nymphal instar: general habitus as in Fig. 8. Pterothoracic marginal setae typically 3+2 each side. Abdomen with discrete paratergites in II-VIII. Rounded small hemitergites discernible on III-VIII, incipient in IX. Tergal setae: II-VIII 2+2. Measurements (n = 7): HL 0.568–0.595, OW 0.584–0.527, TL 1.797–1.973.

Egg: shape longly ellipsoidal (0.708–0.732 x 0.305–0.342), somewhat fusiform (Fig. 9) and reminiscent to that of *Vernoniella biprosapiae* (Carriker, 1956) (see Abrahamovich and Cicchino, 1987), differing as follows. *Operculum* moderately dome-shaped (Figs. 9-10), surface smooth, with an irregular row of 18-28 irregularly spaced air chambers (Figs. 10-11), opercular callus poorly defined, maximum height 0.061-0.072, and maximum diameter 0.146. *Amphora* elongated, with surface smooth and amphoral callus well defined (Fig. 9), its maximum width being 0.305-0.342. *Chorionic hydropyla* as in most Philopteridae, consisting in a number of radial channels plugged with spumaline. The whole hydropyla is completely imbedded in the hygroscopic spumaline, which is responsible for the water balance of the embryo until hatching (Hinton, 1977). *Sites of oviposition*: eggs are glued to the basal half of the underside of the rachis of the feather by means of a moderate amount of spumaline, usually 1-2 per feather. Feathers involve those belonging to the pteryla of the following regions: crown, frons, lores, part of the face, lower portion of the auricular area, chin and upper neck.

Prevalence: In Chile, the only available individual of *C. pitius* was parasitized. In Argentina (Buenos Aires Province) prevalence was very high in *Colaptes campestroides*, 100 % (n = 13), whereas in *C. melanochloros* it was much lower, 53.33% (8 out of 15 individuals examined) between 1972 and 1991.

Type host: *Picoides major pinetorum* (C. L. Brehm, 1831).

Other hosts: Along with the other 50 species of Flickers (Picidae) over the world listed in Price et al. (2003: 365-367), this species has been recorded also from a New World Barbet (Piciformes: Capitonidae): *Eubucco bourcierii* (Lafresnaye) (Price et al*.,* 2003: 364, no locality given).

Remarks: The present record *P. auritus* is the first citation for Chile. It is very interesting to note that Price et al. (2003: 210) cited *Penenirmus jungens* (Kellogg, 1896) for *Colaptes pitius* (and also for *C. rupicola*), unfortunately without indication of locality or even country. If we assume that identifications by the latter authors are correct, these facts open the question of which of the Chilean "geographic populations" of this host are parasitized by *P. auritus* and which by *P. jungens*.

***Penenirmus campephili* Eichler, 1953**

Male and female: Features of both sexes match well the features as well as measurements given by Dalgleish (1972: 101-102, Figs. 7-8) (see Table 2).

Preimaginal instars: These stages are unknown for this species. We only collected a total of seven teneral or subteneral N II and N III (see Table 1), and prudently we prefer not to describe them until securing a complete set of all nymphal mature stages to compare them with *P. auritus* described above.

Type host: *Campephilus magellanicus* (King, 1828).

Other hosts: not known.

Remarks: This species was originally recorded from Loncoche, the type locality (39°22'12" S; 72°37'39" W). In this study we found it on birds from the nearby location of Lago Ranco (40°11'31" S; 72°16'5" W), two other northern locations at Los Maitenes (34°50'41" S; 70°30'27" W) and Nevados de Chillán (36°54'59" S; 71°25'38" W), as well as in Magallanic Isla Navarino (54°55'33" S; 67°49'59" W).

Menacanthus pici (Denny, 1842)

(Figs. 13-16)

Male and female: Features of both sexes match well the features as well as measurements given by Price and Emerson (1975: 779-781, Figs. 1-5). None of the specimens examined from *V. lignarius* nor from *C. pitius* showed the central area of the gular plate translucid. Male genitalia very typical, with basal plate long and wide, 0.40x0.10, parameres slender and slightly curved outwards, endomeral complex very simple, with two very slender and feebly sclerotized endomeres and genital sac wide and provided with a V-shaped penial sclerite (Fig. 16). Body measurements are shown in Table 2.

Preimaginal instars: As it has been pointed out by Cicchino (2003: 5-6) for *M. bonariensis* Cicchino, 2003, the three nymphal instars are readily separated by the number of setae in the gular plates, 0, 2, and 3 each side, respectively. Additional features for NI are the absence of cephalic seta 14 and sensilum *c*. Hence, these features are omitted in the descriptions.

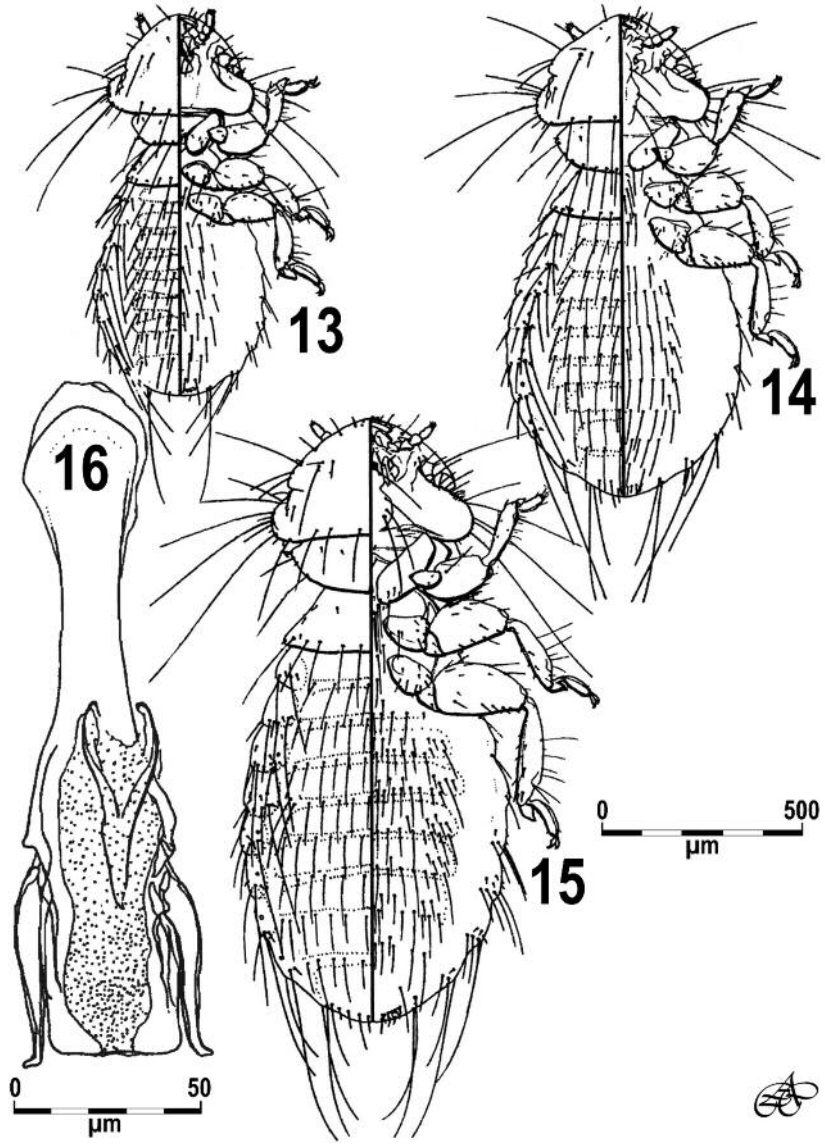
Third nymphal instar: general habitus as in Fig. 15. Tergal setae: II-VIII 5-6 + 5-6. Lateral brushes of setae in abdominal sternites II-V with 4-6 setae each side. Measurements (average of 19 individuals): HL 0.382 OW 0.490, TL 2.028. The body measurements clustered in two ranges, together with discrete differences in the number of setae over all in abdominal sternites, strongly suggests that male and female nymphs of this stage are involved. The examination of mature nymphs of this stage containing the pharates of male and female are necessary to definitively clarify this result.

Second nymphal instar: general habitus as in Fig. 114. Tergal setae: II-VIII 4-5+4-5. Lateral brushes of setae in abdominal sternites II-V with 2-3 setae each side. Measurements (average of 22 individuals): HL, 0.270; OW 0.416; TL, 1.194.

First nymphal instar: general habitus as in Fig. 13. Tergal setae: II-VIII 4+4. No lateral brushes of setae insinuated in abdominal sternites II-V. Measurements (average of 12 individuals): HL 0.235; OW, 0.358; TL 0.881.

Egg: the bizarre egg showing an operculum with an apical phanerum composed of twisted slender strands similar to those of *M. bonariensis* (Cicchino 2003: 7, Fig. 22) is being studied by one of us (ACC) together with the eggs of other species of this genus parasitizing Piciformes and Passeriformes. Sites of oviposition: eggs are glued to the basal half of the rachis of the feather by means of a moderate amount of spumaline, one or more per feather. Feathers involve those belonging to the pteryla of the lower chest, upper abdomen and flanks (Fig. 12).

Prevalence: In Chile, the only available individuals of *Veniliornis lignarius* and *C. pitius* were parasitized. In *C. melanochloros*, the single individual examined parasitized by this species repeated the latter scenario.



Figs. 13-16. *Menacanthus pici* (Denny, 1842), 13 first nymphal instar (N I), 14 second nymphal instar (N II), 15 third nymphal instar (N III), 16 male genitalia.

Type host: Picus viridis Linnaeus, 1758.

Other hosts: Along with the other 19 species of Flickers (Picidae) in the world listed in Price et al. (2003: 124), this species has also been collected from Old World Barbets (Piciformes: Capitonidae) of the genus *Megalaima* G. R. Gray,

Table 2. Mean (± SE) body measurements (mm) of louse species collected from birds of the family Picidae in Chile.

Species	Sex (n)	HL	HW	PL	PW	PTL	PTW	AL	AW	TL
M. campephili	M (2)	0.318±18.3	0.462±3.3	0.183 ± 22	0.452±8	0.152 ± 9.3	0.520±30	1.200	0.780± 18.5	2.010±18.3
M. pici	M (7)	0.318 ± 32.3	0.570 ± 32.3	0.182 ± 20.9	0.427 ± 36.1	0.149 ± 11.3	0.512 ± 21.1	1.189 ± 52.9	0.773 ± 21.5	1.811 ± 63.3
	F (8)	0.323 ± 9.6	0.595± 10.1	0.226 ± 10.3	0.445 ± 11.6	152.1 ± 10.9	0.560 ± 20.7	1.396 ± 46.6	0.881 ± 47.5	2.049 ± 60.8
P. auritus	M (1)	0.580	0.531	0.219	0.307	0.312	0.525	1.033	0.753	1.928
P. campephili	M (4)	0.620 ±18	0.600 ± 13.6	0.234 ± 40	0.354 ± 9.2	0.282 ± 11.8	0.601 ±14.1	1.047 ± 29.5	0.801 ±17.5	2.011 ±59.6
	F (7)	0.653 ± 17.1	0.638 ±19.7	0.235 ±11.6	0.366 ±20.8	0.314 ±23.2	0.667 ±28.8	1.446 ±43.5	0.926 ±23.2	2.455 ±67.1

M = male, F = female

1842 (Price and Emerson 1975). *Veniliornis lignarius*, recorded in the present paper, is a new host for this species.

Remarks: Nymphal instars of this species have been studied by Castro and Cicchino (1978: 80, Figs. 9-11, 12a, 13 and 14) and Martin Mateo (1984: 156-157). Quantitative and metrical discrepancies between the data given by these authors involves N I probably by misidentification of this stage with teneral N II (inferred by us based on gular chaetotaxy 2-3+2-3 given by the latter authoress), and N II and N III (3+3 after the same source), which surely correspond to all N III but belonging to different sexes (male and female N III, see above).

M. pici has been recorded from Chile on *C. pitius* and from Peru on *C. rupicola* by Price and Emerson (1975: 781) and on *C. pitius* and *C. rupicola* by Price et al., 2003: 124) unfortunately without indication of locality or even country. By this, the presence of *M. pici* as a parasite of *C. rupicola* in Chile needs confirmation.

Menacanthus campephili Price & Emerson, 1975

Male: Features of the 2 male individuals from Lonquimay match well the features as well as measurements given by Price and Emerson (1975: 782, Figs. 11-14) (see Table 2).

Female: not recorded.

Preimaginal instars: Are unknown for this species, We only collected a total of three teneral N II, and prudently we prefer not to describe them until securing a complete set of all nymphal stages.

Type host: Campephilus magellanicus (King, 1828).

Other hosts: Not known.

Remarks: This species has been recorded from Isla de los Estados (Tierra del Fuego Province, southern Argentina) (54°48'22" S; 64°22'40" W), and the present two records from Curacautin (38°25'37" S; 71°49'19" W) and Lonquimay (38°27'04" S; 71°22'19" W) (both in the Malleco Province) represent the first record for continental Chile, both placed at least 16° latitude to the north of the type locality.

ACKNOWLEDGMENTS

Research was funded by FONDECYT 1100695 to D. González-Acuña, and by FONDECYT 1090794, BBVA Foundation BIOCON06/109 to R. A. Vásquez, ICM-P05-002, and PFB-23 CONICYT-Chile to R. A.Vásquez and R. Rozzi. Research was conducted under Permit No. 2012 and 5193 issued by the Servicio Agrícola y Ganadero, Chile, with the supervision of the Ethics Committee of the Faculty of Sciences, Universidad de Chile. We are grateful to Corporación Nacional Forestal (CONAF) for access and use of cabins.

LITERATURE CITED

Abrahamovich, A. H. and A.C. Cicchino. 1987. Identificación de los huevos de las especies del género *Vernoniella* Guimaraes 1942 (Mallophaga: Philopteridae) sobre la base de la morfología coriónica. Revista de la Asociación de Ciencias Naturales del Litoral 18 (1): 3-11.

Carriker, M. A. Jr. 1967. The mallophagan genus *Menacanthus* (Insecta: Menoponidae) parasitic on the woodpeckers (Aves: Picidae). Pp. 1-21. In: Emerson, K. C. (*ed*.) Carriker on Mallophaga – Posthumous papers, catalog of forms described as new, and bibliography. United States National Museum Bulletin 248: x + 150 pp.

Castro, D. del C. and A. C. Cicchino. 1978. Contribución al conocimiento de los Malófagos Argentinos III. Sobre algunos Menoponidae de la avifauna bonaerense: *Menacanthus eurysternus* (Burmeister) y *M. pici* (Denny)(Insecta, Mallophaga*).* Revista de la Sociedad Entomológica Argentina 37 (3-4): 77-83.

Castro, D. del C., A. C. Cicchino, S. García, and M. Gutiérrez. 1988. Estudio de la morfología coriónica del huevo de *Menacanthus exsanguis* (Paine y Mann 1913) (Phthiraptera-Menoponidae). Revista de la Asociación de Ciencias Naturales del Litoral 19 (1): 5-10.

Cicchino, A. C. 2003. *Menacanthus bonaeriensis* new species (Phthiraptera: Menoponidae), parasiticonthe White-bellied Sparrow, *Zonotrichia capensis polyleuca* (Todd, 1915) (Aves: Passeriformes: Fringillidae) in Buenos Aires Province, Argentina. Zootaxa 358: 1-11.

Dalgleish, R. 1972. The *Penenirmus* (Mallophaga: Ischnocera) of the Picidae (Aves: Piciformes). Journal of the New York Entomological Society 80: 83-104.

Denny, H. 1842. Monographia Anoplurorum Britanniae. London: Henry G. Bohn. xxiv + 262 pp., pls 1-26.

Dickinson, E. C. 2003. The Howard & Moore complete checklist of the birds of the world (Third edition). Christopher Helm, London. 1040 pp.

Eichler, W. 1953. Mallophagen-Synopsis. XXIV. Genus *Penenirmus* (Incl. *Picophilopterus*). Zoologischer Anzeiger 150: 235-245.

Hinton, H. E. 1977. Function of shell structures of the pig louse and how egg maintains a low equilibrium temperature in direct sunlight. Journal of Insect Physiology 23: 785-800.

Kellogg, V. L. 1896. New Mallophaga, II,—from land birds; together with an account of the Mallophagous mouth-parts. Proceedings of the California Academy of Sciences (series 2) 6: 431-548, pls 60-73.

Martin Mateo, M. P. 1984. Estudio taxonómico y biométrico de los malófagos (Mall.) parásitos de *Picus viridis* L. Boletín de la Asociación Española de Entomología 8: 151-165.

Martínez, D. E. and G. E. González. 2004. Las aves de Chile, Nueva guía de campo. Ediciones del Naturalista. Chile 620 pp.

Mey, E. 1994. Beziehungen zwischen Larvenmorphologie und Systematik der Adulti bei den Vogel-Ischnozeren (Insecta, Phthiraptera, Ischnocera). Mitteilungen aus dem Zoologischen Museum in Berlin 70 (1): 3-84.

Price, R. D. and K. C. Emerson. 1975. The *Menacanthus* (Mallophaga: Menoponidae) of the Piciformes (Aves). Annals of the Entomological Society of America 68(5): 779-785.

Price, R. D., R. A. Hellenthal, and R. L. Palma. 2003. World Checklist of Chewing Lice with Host Associations and Keys to Families and Genera. Pp. 1-488 In Price, R. D., R. A. Hellenthal, R. L. Palma, K. P. Johnson and D. H. Clayton (eds.): The Chewing Lice: World Checklist and Biological Overview. Illinois Natural History Survey Special Publication 24.

Scopoli, J. A. 1763. Entomologia Carniolica exhibens insecta Carnioliae indigena et distributa in ordines, genera, species, varietates, método Linnaeana. Wien: Trattner xxxvi + 421 pp.