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Chionodes meridiochilensis sp. nov. from Chile: contribution to an understanding of its biology and description of its early stages (Insecta: Lepidoptera: Gelechiidae)

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Abstract. *Chionodes meridiochilensis* sp. nov. is described from south central Chile from larvae collected in January 2011. In addition, the present paper describes the morphology and the chaetotaxy of the fifth instar larva, as well as the pupa. Data is also presented on the bionomics of this new gelechiid species, including feeding strategies and food-plant.

Key words. *Chionodes*, Gelechiidae, biology, early stages, Chile.

Resumen. Se describe *Chionodes meridiochilensis*, una nueva especie de geléquido de la región centro-meridional de Chile, a partir de un lote de larvas recogidas en enero de 2011; el trabajo incluye además detalles morfológicos y de la quetotaxia del último estadio larvario y de la pupa. Igualmente, se presentan datos bionómicos de esta especie nueva: estrategias alimenticias y la planta nutricia.

Palabras claves: *Chionodes*, Gelechiidae, biología, estados inmaduros, Chile.

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I. INTRODUCTION

HODGES (1999) includes 231 species in the genus *Chionodes*, HÜBNER (1825) in the Holarctic region, with 185 species (LEE et al. 2009) distributed in North America north of Mexico, 28 species in the Palaearctic (HUEMER & KARSHOLT 1999) with 23 species being recognised from the Neotropics (SCHMITZ & LANDRY 2007). *Chionodes meridiochilensis* sp. nov. is the second species recorded for the genus from Chile, the other being *C. icriodes* (MEYRICK, 1931) (BECKER 1984).

An important apomorphic characteristic of this genus includes the long, rod-like caecum on the aedeagus (HODGES 1999); uncus broad, cap-shaped; distinctive long gnathos;

valva separated into long and slender costa and shorter sacculus (HUEMER & KARSHOLT 1999).

HODGES (1999) stated that the genus *Chionodes* radiated out from temperate North America, three species groups: *formosella*, *obscurusella* and *phalacrus* of the five species groups introduced by HODGES (1999), have radiated out into the Neotropics.

In terms of biological strategies highlighted in the genus *Chionodes*, the larvae are generally leaf-tiers (HODGES 1999). With reference to food-plants, the data there is, suggests polyphagy on a generic level (e.g. Asteraceae, Betulaceae; HODGES 1999) throughout the Holarctic region (HODGES 1999; HUEMER & KARSHOLT 1999), with seven species in the Nearctic being recorded on polygonales (Polygonaceae) (*Eriogonum* MICHAUX, *Rumex* L.), these species being: *C. nanodella* BUSCK, 1910, *C. bardus* HODGES, 1999, *C. luteogeminatus* (CLARKE, 1935), *C. dammersi* (KEIFER, 1936), *C. helicosticus* (MEYRICK, 1929), *C. ochreostrigella* (CHAMBERS, 1875) and *C. violaceofusca* (ZELLER, 1873) (the latter two species refer to captive rearings) (HODGES 1999).

There are no data available on the bionomics of the *Chionodes* genus in Chile.

The area from where material was collected which forms the basis of this paper was within the limits of the University of Concepción campus with evident anthropogenic influence (plantations of *Pinus radiata* and *Eucalyptus* spp.), that would have corresponded to the concept of 'sclerophyllous woodland (Concepción)' according to GAJARDO (1994) to be found between the rivers Itata and Biobío (central south Chile; 200-400 m, 36-38°S). For CAVIERES et al. (2005), the aforementioned pine and gum tree plantations have an important presence in the 'Cordillera de la Costa' and can be considered an important threat to the indigenous flora.

II. MATERIAL AND METHODS

Larvae were collected by examining foilage of *Muehlenbeckia hastulata* (J. E. SM.) JOHNSTON (Polygonaceae) a climber, which also sprawls along the ground in open areas, is regarded as a species indicative of secondary succession, together with other plants such as: *Baccharis linearis* (RUIZ et PAV.) PERS. (Asteraceae), *Retanilla trinervis* MIERS (Rhamnaceae) and *Acacia caven* (MOL.) MOL. (Mimosaceae) (BALDUZZI et al. 1982; ARMESTO & PICKETT 1985; TEILLIER et al. 2010). Inspections were made the last two weeks of January 2011. Larvae were reared in hermetically-sealed plastic containers at normal room temperatures in the laboratory, the food-plant being changed as appropriate, larvae pupating amongst the leaf remains.

Measurements were taken of larvae in the final instar and of pupae using milimetre-squared paper.

Genital preparations were made according to standard procedures (ROBINSON 1976).

SEM photographs were undertaken once the larvae and pupae had undergone dehydration after having been bathed in 70, 80, 90, 100% ethanol and then fixed to stubs with carbon-based stickers and coated with gold-palladium (40/60%) using a sputter coater.

Terms related to larval and pupal structure and chaetotaxy according to (HINTON 1946; HODGES 1999; HASENFUSS & KRISTENSEN 2003; ADAMSKI et al. 2010).

III. RESULTS

Seven larvae were collected as follows: 13.I.11: 2 specimens: 1 x L4; 1 x L5; 1st pupa noted: 27.I.11 (emergence: 12.II.11 c. 15 days as pupa); 14.I.11: 3 specimens: L3-L5 1 specimen in each stadium; 1st pupa noted: 21.I.11; 2 further being noted: 27.I.11; only one larva made a cocoon; white; attached to piece of paper: 15.I.11: 1 specimen (L2); 20.I.11: 1 specimen (L5); observations made of the captive larvae (23.I.11) indicated the following: four larval specimens were in L3, L4 and L5 (2); 1 larva in the pre-pupal phase; 1 pupa (emergence: 27.II.11 c. 37 days as pupa). The following measurements were made: L2: 5. 7 mm (n=1); L5: 15. 1mm (n=1). Emergencies: only two imagines were obtained of the 7 larvae taken (28. 6%) emerging under winter conditions in Europe (unheated room in Madrid).

IV. SYSTEMATIC PART

Family: **Gelechiidae** STAINTON, 1854

Subfamily: **Gelechiinae** STAINTON, 1854

Chionodes meridiochilensis sp. nov.

D i a g n o s i s. Amongst the *Chionodes*, *C. meridiochilensis* is similar, at least in terms of fore-wing background tone, to *C. discoocellellla* (CHAMBERS, 1872) (Nearctic) and to the Neotropical *Filatima persicaeella* (MURTFELDT, 1899) (Gelechiinae) and to *Dichomeris stratella* (WALSINGHAM, 1897) (Dichomeridinae). The uncus is as broad as *C. stefaniae* SCHMITZ & LANDRY, 2007 and *C. manabiensis* SCHMITZ & LANDRY, 2007 described from Ecuador, both of these species also have the relatively conspicuous 'notch' on the anterior margin of the uncus in common with *C. meridiochilensis*. However, unlike *C. stefaniae* and *C. manabiensis*, the gnathos in *C. meridiochilensis* is slightly longer ending in a darker fashion distally as well as being 'sharp' rather than 'blunt'. Caecum in *C. stefaniae* and *C. manabiensis*, is c. 25% of the length of the aedeagus, whereas in *C. meridiochilensis* it is c. 80% the length of same.

D e r i v a t i o n o m i n i s. *Meridionalis*: 'of southern provenance'; *meridio*: adjective; *chilensis*: genitive of Chile; 'from the south of Chile'.

M a t e r i a l e x a m i n e d. Holotype: 1 ♀ *ex larva* 13.I.11; emerged 12.II.11; Chile: Región de Biobío; Concepción, campus universitario, 200m; genitalia preparation no: 3711 G. E. KING leg. Paratype: same data as holotype but: 1 ♂ *ex larva* 20.I.11, emerged 27.II.11; genitalia preparation no: 3713 G. E. KING leg.

Larvae (2) and pupa (1) I.11, Región de Biobío; Concepción, campus universitario, 200 m.

Holotype and paratype deposited in Museo Nacional de Ciencias Naturales (MNCN), Madrid, Spain; early stage material presently at the Universidad Autónoma de Madrid (to be deposited at the MNCN).

D e s c r i p t i o n. Imago ♂ (n=1): fore-wing length 9. 9 mm; labial palp strongly recurved; segment 3 with silvery-grey tip; scales dark ochre distally, scales intermingled with lighter ochre; ventral brush segment 2 with greyish-white scales; head, thorax and tegula scales pigeon-grey interspersed with black; seen under light source tegular scales have a peacock-green sheen; antenna: filiform; heavily scaled in blackish-silvery grey; ringed greyish; pronounced 'notch' near basal area wherein scales are tan-ochre; fore-wing: elongate rectangular; slate-grey; costal margin blackish-grey interspersed with paler scales; discal spot: rough triangular shape whitish-ochre; then two smaller elongated maculae in same colour; distal spots: one larger whitish-ochre; also one smaller, both with barely perceptible black base; apex margin divided into two; ochre inner margin; cilia line rust-ochre; cilia same tone as inner margin but with barely perceptible paler ochre finish; costal margin shows costal spot in same ochre shade as apex region; dorsum: antemedian line black which is narrower near costal margin; line in dorsum area broken into two; post-median line rust-ochre; tornus whitish-yellow; hind-wings: greyish-silvery white; cilia straw-blonde with exception of area near termen where tinged in ochre (Fig. 1).

Male genitalia (n=1): Uncus: prominent, broad, spatula-shaped with pronounced bifurcation on anterior margin; gnathos with pronounced mesal hook curved upwards darkening in distal area to dark ochre, reddish-ochre at base; fultura superior complete; teguma relatively long terminating in pedunculi slightly tapering; vinculus broad circular-shaped base; valve slender; saccus: double v-shaped basally tapering terminally; aedeagus: long and slender, slightly sclerotisised tooth-shaped form found distally; whip-shaped caecum terminating in spatula form (Figs 2, 3).

Imago ♀ (n=1) (Fig. 4): fore-wing length 12. 1 mm: abdomen dorsally blackish-grey; laterals silvery-white; 10th segment tufts pale ochre; similar to male; this example eclosed with fore-wings slightly curved distally at apex, also scales and cilia slightly amiss due to 'trauma at eclosion'. Mid-legs: femur: dorsal surface silvery-white ventral surface scales blackish-ochre; tibia: two sets of setal brushes; anterior set: pinkish-ochre distally, dark ochre basally; posterior set: 'feather-like' 'striped' in pinkish and ochre; tarsus: scales similar to hind-leg; hind-legs: femur: silvery-white; tibia: 3 spurs present; thickly clothed in blonde brush-like setae; tarsus clothed in blackish-ochre scales terminating in whitish-ochre; lengthwise, hind-legs are c. 50% longer than mid-legs.

Female genitalia (n=1): papillae analis present blunt-triangular shaped process distally; apophyses posteriores c. 25% length of apophyses anteriores these terminate in barely perceptible projection; antrum more or less ribbon-shaped; ductus bursae narrow; corpus bursae relatively small but with irregular tear-shaped signum (Figs 5, 6).

E a r l y s t a g e s. Larval morphology (L5): 15. 1 mm (n=1) (Fig. 7): hypognathous; shiny black; T1: shiny-black; T2, T3 shiny violet-black; interstitials waxy-yellowish-green; A1-A10: dorsal line violet interspersed greenish-white lines; dorsal line twice as wide as semi-dorsal lines in greenish-white; semi-dorsal zone and lines are progressively narrower. Chaetotaxy: (L5) (n=1) (Fig. 8): the six stemmata form an 'interrogation mark

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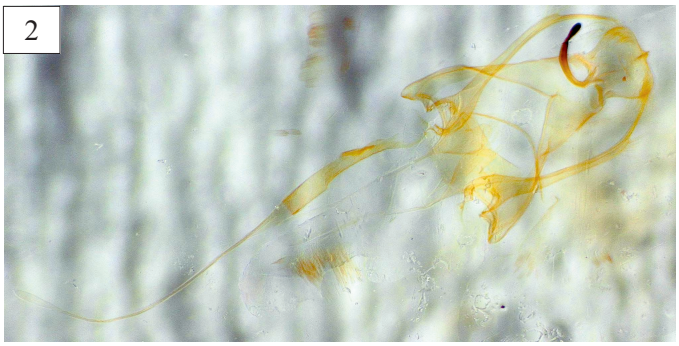

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Fig. 1. *Chionodes meridiochilensis* sp. nov.: holotype: ♂ *ex larva* 13.I.2011; emerged 12.II.2011; Chile: Región de Biobío; Concepción, campus universitario, 200 m; genitalia preparation no: 3711 G. E. KING leg.
Fig. 2. *Chionodes meridiochilensis* sp. nov.: ♂ genitalia: *ex larva* 13.I.2011; emerged 12.II.11; Chile: Región de Biobío; Concepción, campus universitario, 200 m; genitalia preparation no: 3711 G. E. KING leg.
Fig. 3. *Chionodes meridiochilensis* sp. nov.: aedeagus: *ex larva* 13.I.11; emerged 12.II.2011; Chile: Región de Biobío; Concepción, campus universitario, 200 m; genitalia preparation no: 3711 G. E. KING leg.

shape' the smallest is ocello 5, being 75% of the largest: ocello 3; ocelli 1, 2, 3 are evenly-spaced at approx. 50% of an ocello; 3, 4 almost touch one another's base; ocello 5 at one ocello distant fro m ocello 6, but two ocellos distant from ocello 4; ocello 5 in relation to ocello 1 is approx. five ocequal distance between ocellos 2, 3; O3 (long, thin), O2, ocello 1, A3 form an ascendant line ellos distant; seta O2 is almost alongside ocello 1; O1 is at almost ventrally; SO2 (long, thin) touches ocello 6 with SO3 (thicker, thinning distally) in a descending line below it; antenna (*antacorium*: 'lip-shaped') sensilla 2nd segment is rather

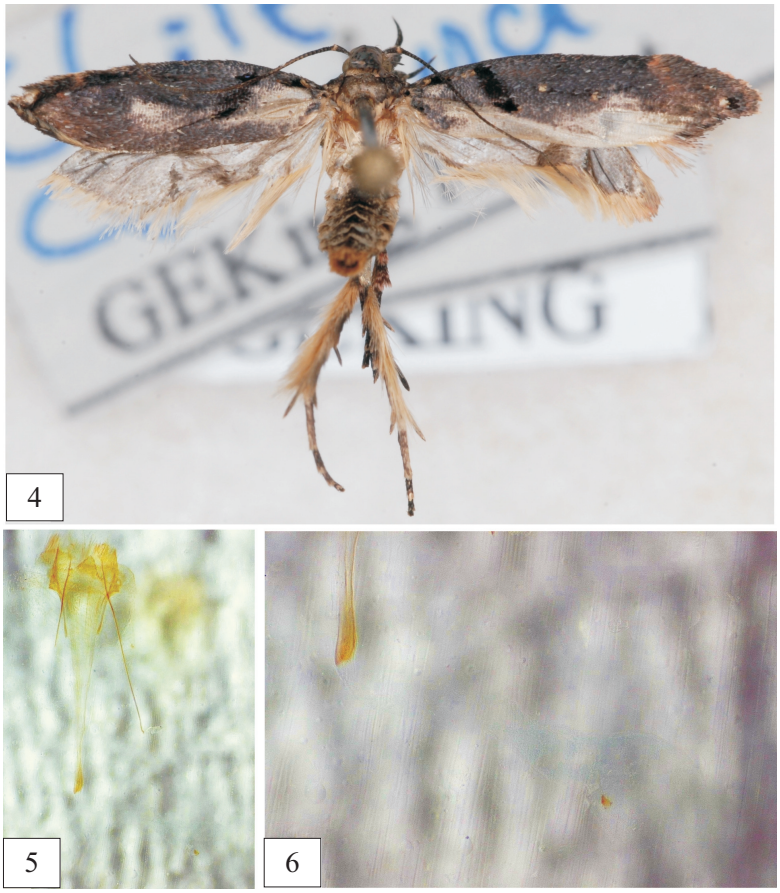

Fig. 4. *Chionodes meridiochilensis* sp. nov.: paratype: ♀ *ex larva* 20.I.11, emerged 27.II.2011; Chile: Región de Biobío; Concepción, campus universitario, 200 m; genitalia preparation no: 3713 G. E. KING leg.
Fig. 5. *Chionodes meridiochilensis* sp. nov.: ♀genitalia: *ex larva* 20.I.2011, emerged 27.II.2011; Chile: Región de Biobío; Concepción, campus universitario, 200 m; genitalia preparation no: 3713 G. E. KING leg.
Fig. 6. *Chionodes meridiochilensis* sp. nov.: signum: *ex larva* 20.I.2011, emerged 27.II.2011; Chile: Región de Biobío; Concepción, campus universitario, 200 m; genitalia preparation no: 3713 G. E. KING leg.

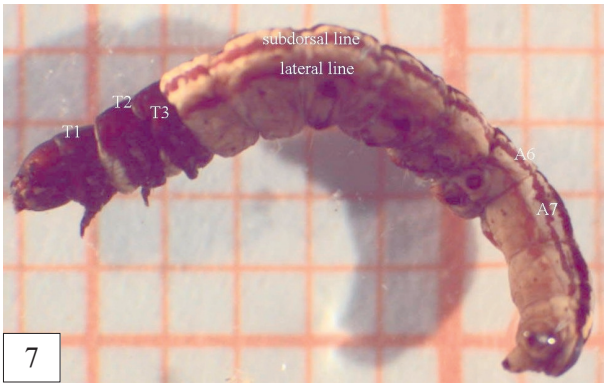

Fig. 7. *Chionodes meridiochilensis* sp. nov.: larva 20.I.2011, Chile: Región de Biobío; Concepción, campus universitario, 200 m, G. E. KING *leg.*

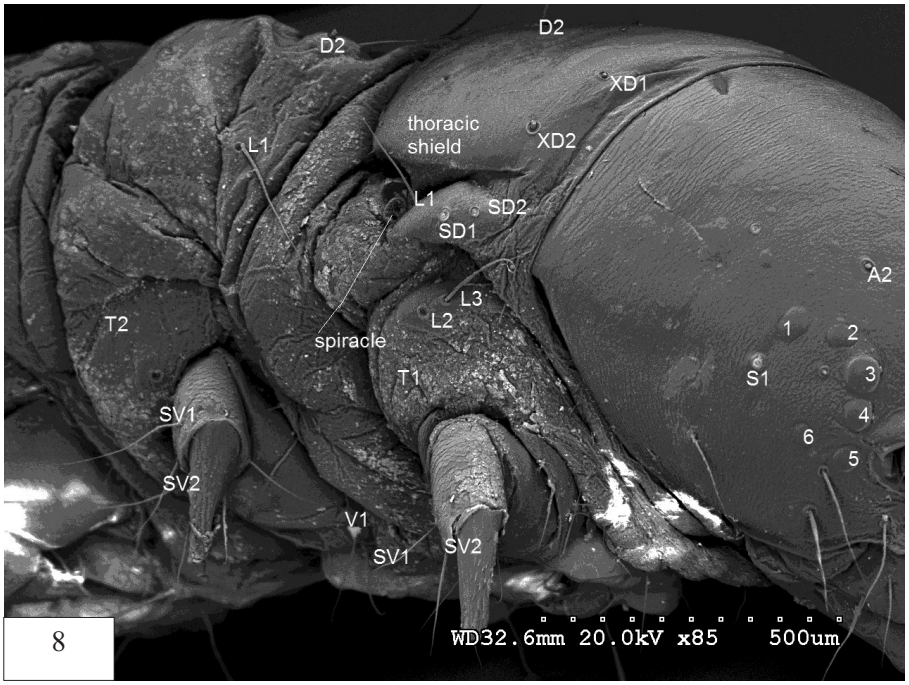

Fig. 8. *Chionodes meridiochilensis* sp. nov.: larva L5: head lateral view; thoracic region T1, T2: I.2011, Chile: Región de Biobío; Concepción, campus universitario, 200 m, G. E. KING leg.

Fig. 9. *Chionodes meridiochilensis* sp. nov.: larva L5: A6; abdominal pro-leg: I.11, Chile: Región de Biobío; Concepción, campus universitario, 200 m, G. E. KING leg.

long; labrum characterized by the LR setae with LR5 six times the length of LR1, LR2, LR6; thoracic region: T1 (Fig. 8): thoracic shield extends half-way down this segment; D2 below D1; SD1 (long, thin in circular-shaped pinnacle), L2, L1 anterior to spiracle, these latter setae at same level but below SD1; SV1, SV2 at same level anterior to coxa; abdominal region: A3 SV1, SV2, SV3 (similar length and width) anterior to the first pair of abdominal pro-legs; A10 (Figs 10, 11) anal shield rounded; D2, SD1, D1 (absent in image); anal comb present: 'fork-shaped'; PP1 anterior margin anal pro-legs, upwardly-turning; anal pro-legs (Fig. 11) L1, L2 at same level anteriorly; L3, SV3, Z (according to GERASIMOV 1939; HUERTAS DIONISIO 2006b) (long, fine) posterior margin of anal pro-leg.

Pupal description (n=1): obtect: ♀ 6. 5 mm; ♂ 6. 9 mm (n=2): glossy chestnut-brown cremaster-less; eye sheaths not prominent; clypeus slightly 'angular' which could play a role in cocoon-cutting (HASENFUSS & KRISTENSEN 2003); labrum 'rectangular' in form (Fig. 12); pterotecas do not extend beyond urito A6 which bears a pair of proleg scars (Fig. 15); A7 is bordered by a pronounced wavy 'fringe' in both male and female pupae (Fig. 14), this structure cannot be assumed to have a stridulatory function as A8 is not an adjacent movable segment, however, as the larva constructs a cocoon there is a possibility that it 'grates' against this, or indeed is used to secure the pupa as the imago emerges (HASENFUSS & KRISTENSEN 2003). Despite the 'denuded' ventral surfaces of A8-A9 there is a pair of 'spiny' patches on A8 which may play a similar role in emergence (Fig. 16). Image of pupal dorsal surface (Fig. 17) does not indicate the presence of posteriorly directed spines to assist in imago emergence (HASENFUSS & KRISTENSEN 2003); spiracles are on a cone-like projection (Fig. 17).

B i o l o g y. *Chionodes meridiochilensis* sp. nov. is to be found as a larva feeding on *Muehlenbeckia hastulata* in the austral mid-summer months with the imagines emerging shortly afterwards, presumably producing a second brood; probably the winter months would be spent in the larval stage in common with other species in the genus *Chionodes* (HODGES, 1999). In terms of feeding strategies employed by the larvae as noted in the wild; larvae do not feed exposed, as would be expected amongst larvae studied in this genus (HODGES 1999), but construct 'feeding tubes' with leaves tightly rolled-up, the midrib forming the 'backbone' of the 'tube', the larvae when disturbed crawl out backwards at speed from the 'tube' with the opening being at the opposite end to the leaf stem. The 'tube' occupied by a larval host slowly dries up, the larvae feeding on fresh leaves by scraping at the parenchyma of a new leaf. Larval 'tubes' are attached to fresh leaves by silken threads, for this reason, it is relatively easy to find larvae as the 'tubes' stand out against the fresh green leaves being consumed, however, not all larvae were taken from dried-up 'tubes', some of the 'tubes' must have been recently attacked by larvae, presumably, larvae are able to occupy new 'tubes' as they develop. Of the seven larvae found; specimens were taken at varying heights within the plant strata, at least one was observed feeding from a shoot actually exposed on bare ground.

D i s t r i b u t i o n. *Chionodes meridiochilensis* sp. nov. is only known from the south-central Chilean province of Concepción.

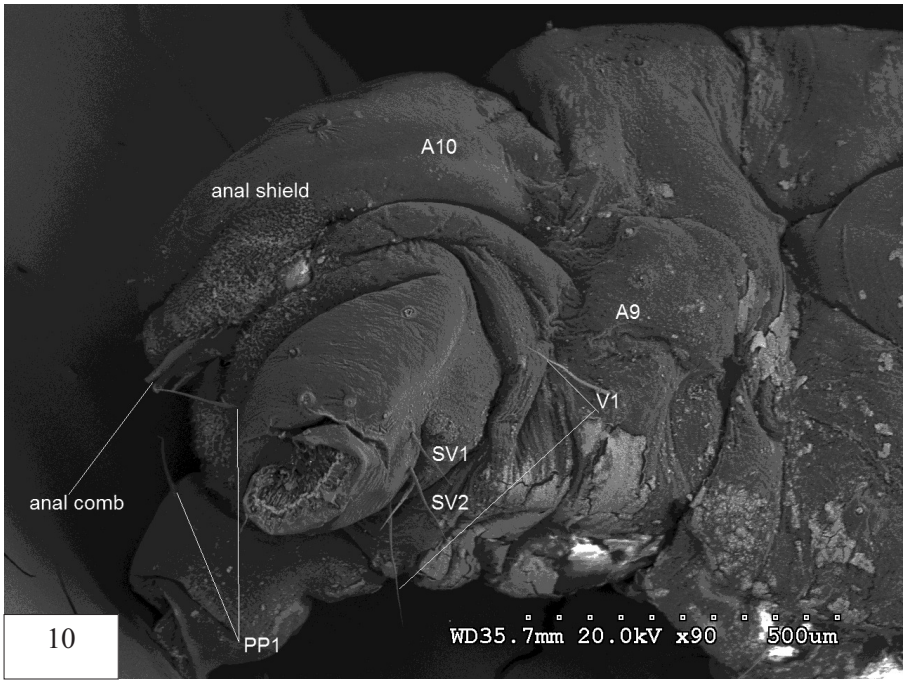

Fig. 10. *Chionodes meridiochilensis* sp. nov.: larva L5: A10; anal shield, anal comb, setae: I.2011, Chile: Región de Biobío; Concepción, campus universitario, 200 m, G. E. KING leg.

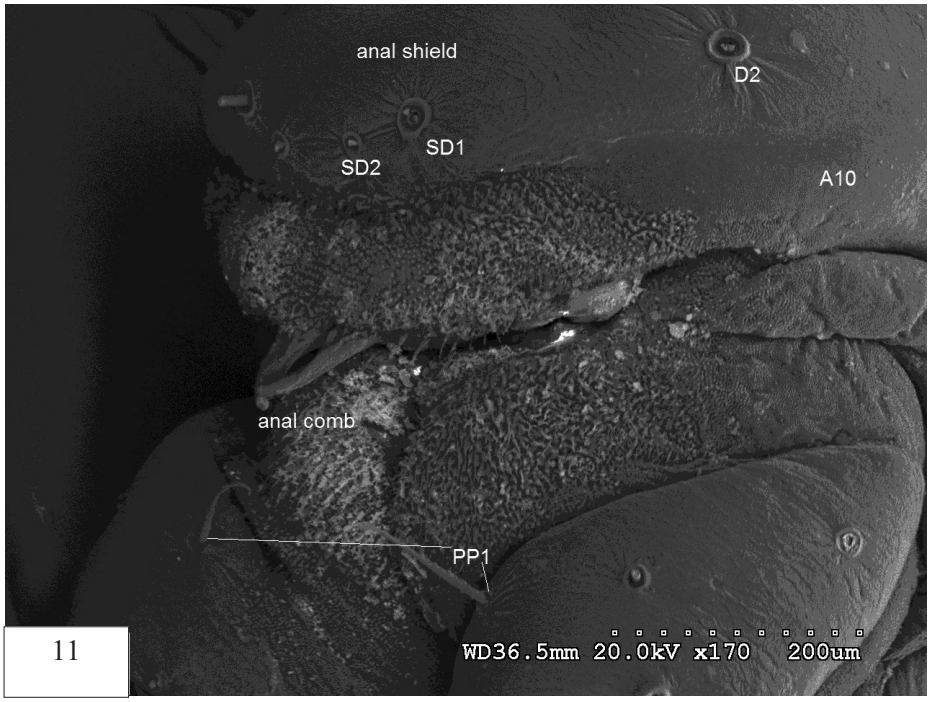

Fig. 11. *Chionodes meridiochilensis* sp. nov.: larva L5: A10; anal shield, anal comb, setae: I.2011, Chile: Región de Biobío; Concepción, campus universitario, 200 m, G. E. KING leg.

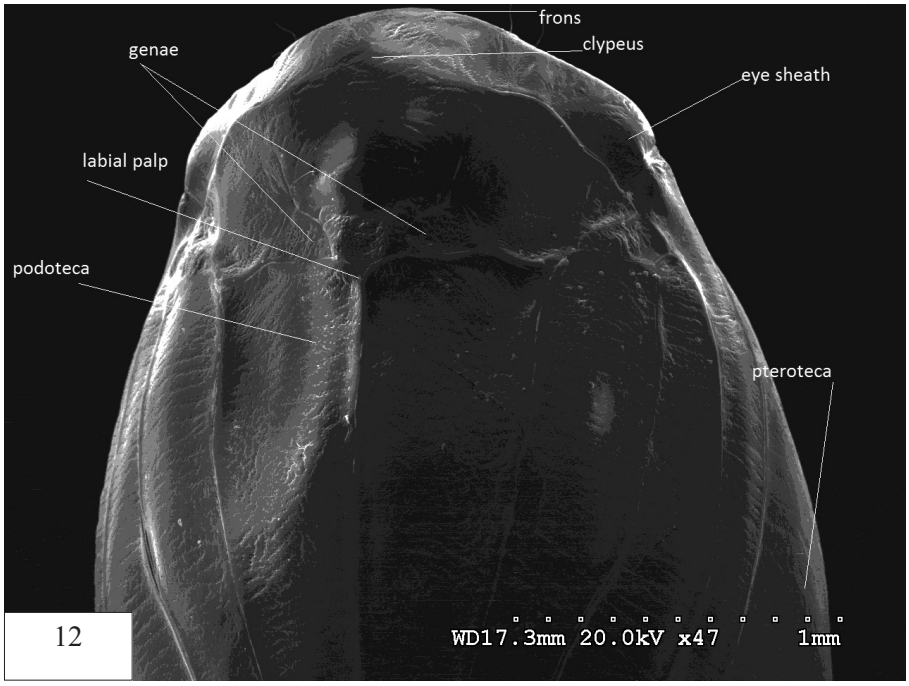

Fig. 12. *Chionodes meridiochilensis* sp. nov.: ♂ pupa ventral view anterior zone; *ex larva* I.2011, Chile: Región de Biobío; Concepción, campus universitario, 200 m, G. E. KING leg.

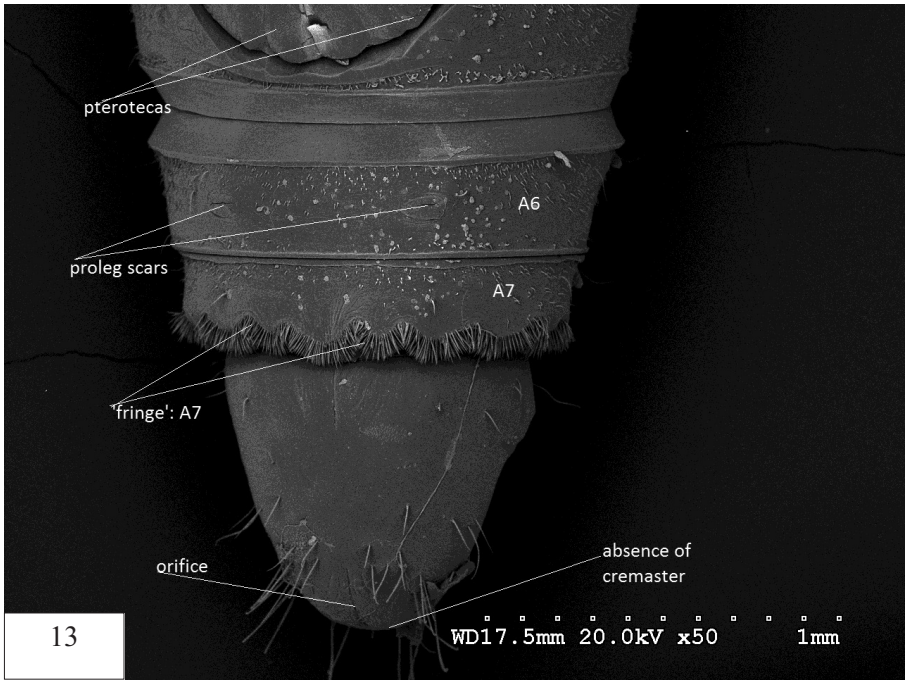

Fig. 13. *Chionodes meridiochilensis* sp. nov.: ♂ pupa ventral view posterior zone; *ex larva* I.2011, Chile: Región de Biobío; Concepción, campus universitario, 200 m, G. E. KING leg.

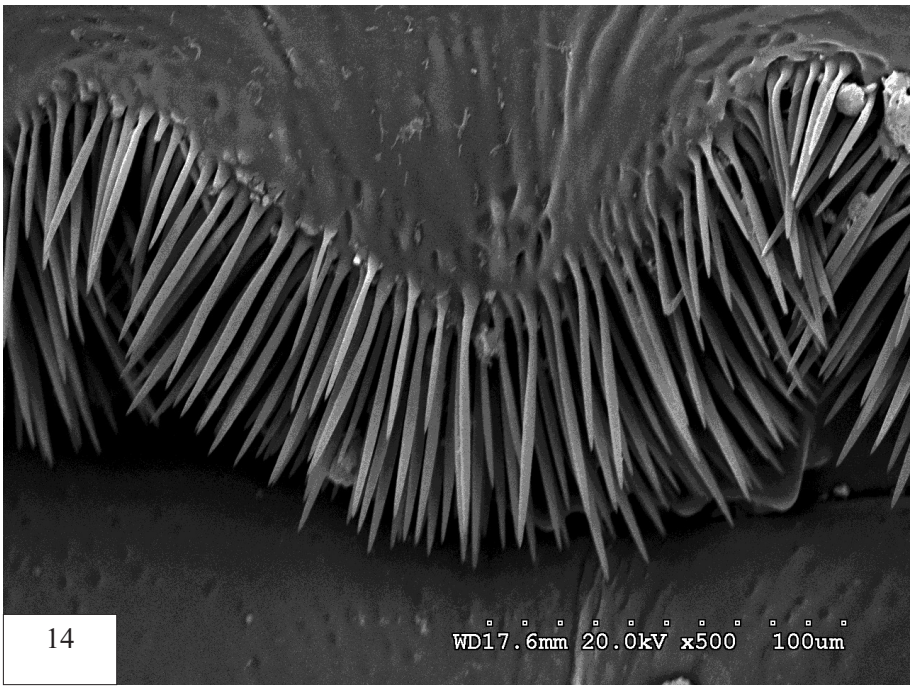

Fig. 14. *Chionodes meridiochilensis* sp. nov.: ♂ pupa ventral view: A7 'fringe'; *ex larva* I.2011, Chile: Región de Biobío; Concepción, campus universitario, 200 m, G. E. KING leg.

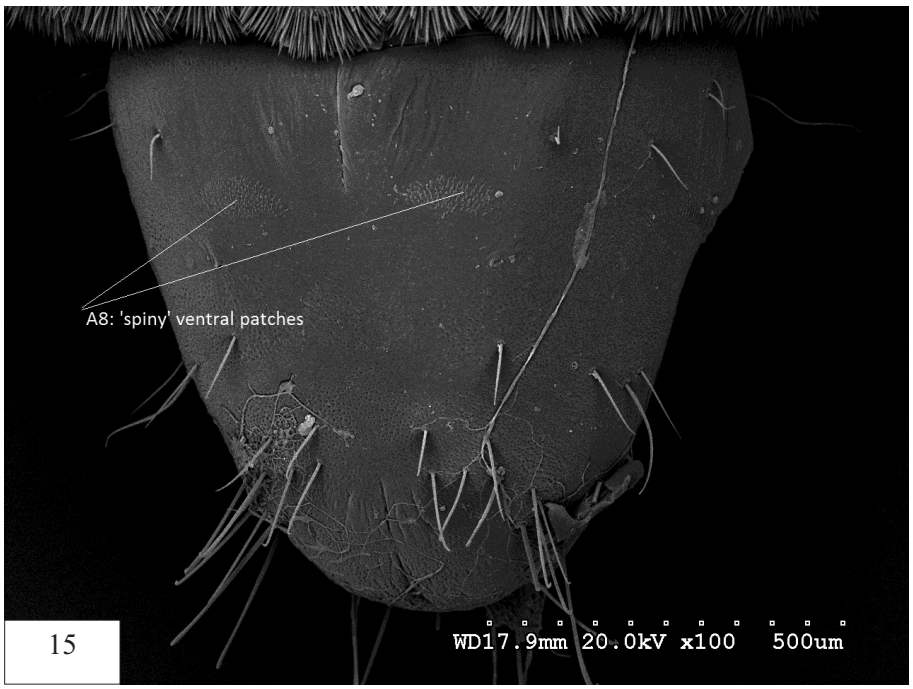

Fig. 15. *Chionodes meridiochilensis* sp. nov.: ♂ pupa ventral view: A8 'spiny' ventral patches; *ex larva* I.2011, Chile: Región de Biobío; Concepción, campus universitario, 200 m, G. E. KING leg.

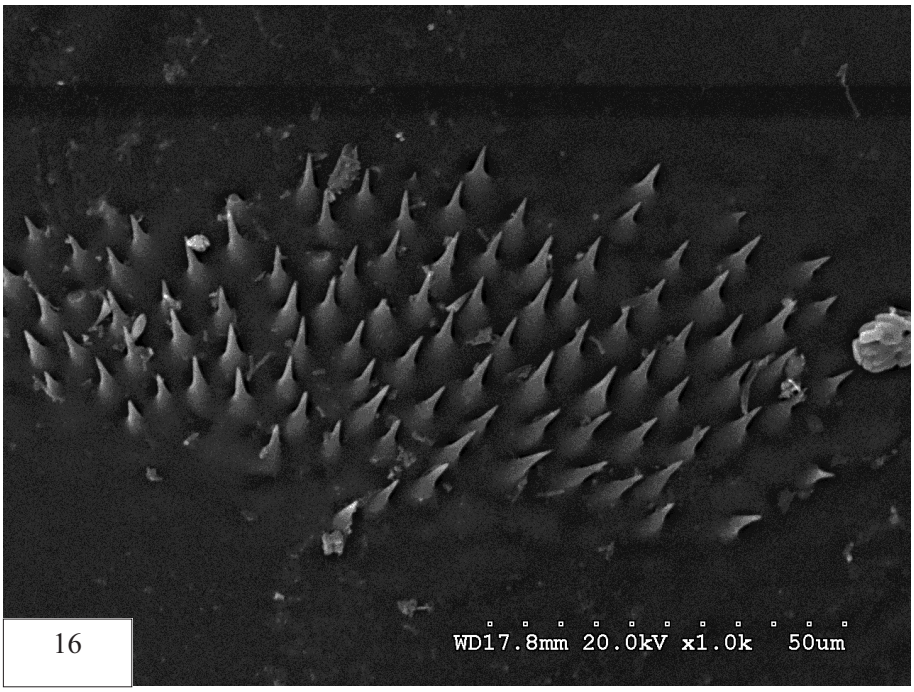

Fig. 16. *Chionodes meridiochilensis* sp. nov.: ♂ pupa ventral view: A8 'spiny' ventral patch; *ex larva* I.2011, Chile: Región de Biobío; Concepción, campus universitario, 200 m, G. E. KING leg.

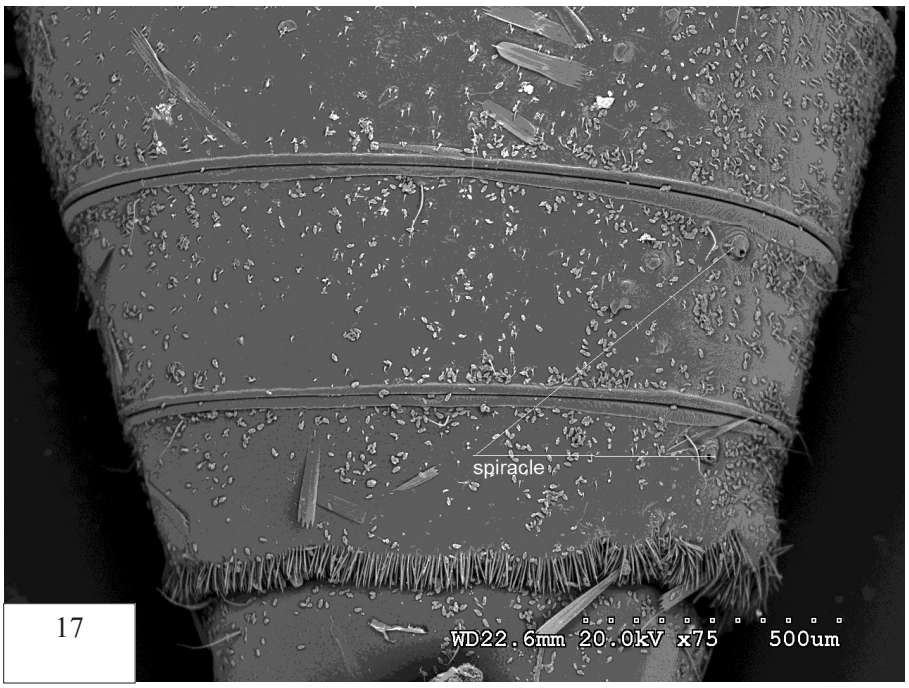

Fig. 17. *Chionodes meridiochilensis* sp. nov.: ♂ pupa dorsal view: spiracles; absence of dorsal spines; *ex larva* I.2011, Chile: Región de Biobío; Concepción, campus universitario, 200 m, G. E. KING leg.

V. DISCUSSION AND CONCLUSIONS

This paper has described the final instar larva, pupa and food-plant of *Chionodes meridiochilensis* sp. nov. along with a brief description of its feeding strategies, it is of note, that the genus, with the description of this new species now includes a species which does not 'tie' the leaves of its food-plant, but constructs a 'feeding tube' within which the hidden larva feeds on the parenchyma of another, fresher leaf. Other 'feeding tube' strategists include those that 'fold' leaves (*C. ludio* HODGES, 1999), but those that construct feeding tubes' are those restricted to species whose life strategies take place in sand or in lichens (HODGES 1999).

The Nearctic *C. discoocellellla* also feeds on polygonales: *Persicaria punctata* (ELLIOT) and *P. glabra* (WILLDENOW) feeding and pupating under a web spun ventrally on the leaf (HEPPNER & HABECK 1976).

In terms of the morphology of the larvae, the distinctive colouration of the thoracic region (Fig. 7) puts them on par with larvae in the Dichomeridinae (Gelechiidae) (HODGES 1986; HUERTAS DIONISIO 2002; 2006a; 2008).

HODGES (1999) describes the chaetotaxy of two *Chionodes* species: *C. trichostola* (MEYRICK, 1923) and *C. arenella* FORBES, 1922, it can be appreciated that O2, ocello 1, A3 also form an ascendant line lateral of cephalic capsule (Fig. 8) as is the case with *Chionodes meridiochilensis* sp. nov.

In terms of the pupa and a possible synapomorphy with other species, there are four taxa whose pupa are described in PATOČKA & TURČANI (2005) these being: *C. luctuella* (HÜBNER, 1793), *C. electella* (ZELLER, 1839), *C. fumatella* (DOUGLAS, 1850) and *C. tragicella* (HEYDEN, 1865) all are bereft of a cremaster, this being replaced by series of ventral setae, as is the case with *Chionodes meridiochilensis* sp. nov.

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RFERENCES

ADAMSKI D., LANDRY J. F., PASSOA S., TRACY R. A. 2010. History, distribution, and identification of *Exoteleia dodecella* (L.) (Lepidoptera: Gelechiidae) in North America, with insights into the systematics of

Exoteleia wallengren using characters of the adult, immatures, bionomics, and DNA barcodes. *Proceedings of the Entomological Society of Washington*, **112**(2): 183-206.

ARMESTO J., PICKETT S. T. A. 1985. Mechanisms of succession in the Chilean matorral. *Revista Chilena de Historia Natural*, **58**(1): 9-17.

BALDUZZI A., TOMASELLI R., SEREY I., VILLASEÑOR R. 1982. Degradation of the mediterranean type vegetation in central Chile. *Ecologia Mediterranea*, **8**: 223-240.

BECKER V. O. 1984. Gelechiidae [In:] J. B. HEPPNER (ed.) – Atlas of Neotropical Lepidoptera, Checklist, part 1. Pp: 44-53.

CAVIERES L. A., MIHOC M., MARTICORENA A., MARTICORENA C., BAEZA C. M., ARROYO M. T. K. 2005. Flora vascular de la Cordillera de la Costa en la región del Biobío: riqueza de especies, géneros, familias y endemismos.[In:] C. SMITH-RAMÍREZ, J. J. ARMESTO, C. VALDOVINOS (eds) – Historia, biodiversidad y ecología de los bosques costeros de Chile. Edición Universitaria, Santiago de Chile. Pp: 245-277.

GAJARDO R. 1994. La vegetación natural de Chile. Clasificación y distribución geográfica. Edición Universitaria, Santiago, Chile. 165 pp.

GERASIMOV A. M. 1939. Die Chaetotaxie des analsegments der Raupen. *Zeitschrift des Östereichischen Entomologischen Vereins*, **24**: 36-39, 50-59, 71-78.

HASENFUSS I., KRISTENSEN N. P. 2003. Skeleton and muscles: Immatures. [In:] N. P. KRISTENSEN (ed.) – Lepidoptera: Moths and butterflies 2. Handbuch der Zoologie/Handbook of Zoology IV/36. Walter de Gruyter, Berlin and New York. Pp: 133-164.

HEPPNER J. B., HABECK D. H. 1976. Insects associated with *Polygonum* (Polygonaceae) in north-central Florida I: Introduction and Lepidoptera. *Florida Entomologist*, **59**(3): 231-239.

HINTON H. E.1946. On the homology and nomenclature of the setae of lepidopterous larvae, with some notes on the phylogeny of the Lepidoptera. *Transactions of the Entomological Society of London*, **97**: 1-37.

HODGES R. W. 1986. Gelechioidea, Gelechiidae (part), Dichomeridinae, fascicle 7. [In:] The Moths of America North of Mexico, including Greenland. The Wedge Entomological Research Foundation, Washington, USA. Pp. 195.

HODGES R. W. 1999. Gelechioidea, Gelechiidae (part), Gelechiinae (Part-*Chionodes*), fascicle 7. 6. [In:] The Moths of America North of Mexico, including Greenland, The Wedge Entomological Research Foundation, Washington, USA. Pp. 339.

HUEMER P., KARSHOLT O. 1999. Gelechiidae I (Gelechiinae, Teleiodini, Gelechiini), vol. 3, [In:] P. HUEMER, O. KARSHOLT, L. LYNEBORG (eds) – Microlepidoptera of Europe. Apollo Books, Stenstrup, Denmark.

HUERTAS DIONISIO M. 2002. Estados inmaduros de Lepidoptera (XVI). *Telephila schmidtiellus* (HEYDEN, 1848) en Huelva, España (Insecta: Lepidoptera). *SHILAP Revista de Lepidopterología*, **30**(117): 9-14.

HUERTAS DIONISIO M. 2006a. Estados inmaduros de Lepidoptera (XXVII). Tres especies del género *Dichomeris* HÜBNER 1818 en Huelva, España (Lepidoptera: Gelechiidae). *SHILAP Revista de Lepidopterología*, **34**(136): 395-406.

HUERTAS DIONISIO M. 2006b. Estados inmaduros de Lepidoptera (XXVI). Helcystogramma triannulella (Herrich-Schäffer, 1854) en Huelva, España (Insecta: Lepidoptera). *SHILAP Revista de Lepidopterología*, **34**(135): 213-228.

HUERTAS DIONISIO M. 2008. Estados inmaduros de Lepidoptera (XXXII). Quetotaxia de las patas de las orugas (Insecta: Lepidoptera). *SHILAP Revista de Lepidopterología*, **36**(142): 149-154.

LEE S., HODGES R. W., BROWN R. L. 2009. Checklist of Gelechiidae (Lepidoptera) in America North of Mexico. *Zootaxa*, **2231**: 1-39.

PATOČKA J., TURČANI M. 2005. Lepidoptera Pupae, Central European Species, vols I & II. Apollo Books, Stenstrup, Denmark. Pp. 863.

ROBINSON G. S. 1976. The preparation of Lepidoptera genitalia with special reference to the Microlepidoptera. *Entomologist's Gazette*, **27**: 127-132.

SCHMITZ P., LANDRY B. 2007. Two new species of *Chionodes* HÜBNER from Ecuador, with a summary of known Galapagos records of Gelechiidae (Lepidoptera). *Revue Suisse de Zoologie*, **114**(2): 175-184.

TEILLIER S., FIGUEROA J. A., CASTRO A. S. 2010. Especies exóticas de la vertiente occidental de la cordillera de la Costa, provincia de Valparaíso, Chile central. *Gayana Botánica*, **67**(1): 27-43. Online versión.