

ENTOMOLOGY

Genus *Delplanqueia* Leraut, 2001 and *D. inscriptella* (Duponchel, 1836) (Lepidoptera, Pyralidae) in Italy

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Abstract

To verify the presence in Italy of *Delplanqueia inscriptella*, today accepted as a separate species from *D. dilutella*, we carried out the study of the historical collections of Carlo Prola and Federico Hartig and new material that was recently collected in central Italy. Both species are present in continental Italy and Sicily while only *D. inscriptella* in Sardinia. The bibliographic reconstruction and the examination of the Hartig's specimens that revealed the presence of *Delplanqueia cortella*, for a long time considered a corso-sardinian endemism, is not reflected: the specimens in Hartig's collection with *P. cortella* placement are indeed *Pempeliella matilella*.

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Introduction

The genus *Delplanqueia* by Leraut (2001) includes four species: *dilutella* (Denis & Schiffermüller, 1775), *inscriptella* (Duponchel, 1836), *cortella* (Constant, 1884) and *nobilella* (Ragonot, 1887).

Delplanqueia dilutella and *D. inscriptella* have been confused for a long time. At present Leraut (2014) mentioned them as two different species and, therefore, *D. subornatella* (Duponchel, 1837) as a synonym of *dilutella*.

In this new framework, several researchers have begun to study the distribution of *D. inscriptella*. In Europe, it was found in Malta (Asselbergs *et al.*, 2008), England (Agassiz, 2015), Denmark (Buhl *et al.*, 2016), Switzerland (Schmid, 2016), Belgium (Slootmaekers *et al.*, 2018), Germany (Wittland and Seliger, 2016), Slovakia (Pastoralis *et al.*, 2017), Balkan Peninsula (Plant *et al.*, 2017) and Iberian Peninsula and Balearic Islands (Ylla *et al.* 2019).

In Italy, according to "Check list della fauna d'Italia" (Bassi *et al.*, 1995), the species *cortella* and *dilutella* are attributed to the genus *Pempeliella*. *Pempeliella cortella* is cited for northern Italy and Sardinia, while *dilutella* for the north of Italy and the isles, Sicily and Sardinia. Recently, *P. dilutella*, but still considered as *inscriptella*, was also recorded in an ongoing survey of the Lepidoptera fauna in central (Pinzari, 2009, Pinzari *et al.*, 2010; Pinzari and Sbordon, 2013; Pinzari *et al.*, 2013a, 2013b, 2015; Pinzari, 2016a, 2016b; Pinzari *et al.*, 2016a, 2016b, 2017a, 2017b, 2018a, 2018b, 2019a, 2019b; Pinzari, 2019; Pinzari & Pinzari, 2019) and southern Italy (Scalercio, 2016). According to Leraut (2001), to clarify our understanding of the distribution of these species in Italy and also verify the goodness of the historical faunistic information in the literature of the last century, we studied dissecting recently-collected specimens in our collection and other private collections of central Italy and examining specimens from all Italian regions in ancient collections in "Museo civico di Zoologia di Roma" and "Museo di Zoologia dell'Università la Sapienza di Roma".

Here, we provided information on the geographical distribution of *Delplanqueia* group in Italy and newly showed the presence of *D. inscriptella* in Italy.

History and distribution of *Delplanqueia* group in Italy before Leraut (2014)

In the Checklist of Italian fauna, Bassi *et al.* (1995) mentioned *D. cortella* in the north of Italy and Sardinia, while *dilutella* (Denis & Schiffermüller, 1775) (= *dilutella* Hübner, 1796= *ador-*

natella Treitschke, 1835=*subornatella* Duponchel, 1837=*integella* Staudinger, 1859=*integrella* Wocke, 1871) in the north, Sicily and Sardinia.

Speidel *et al.* (2013) in Fauna Europaea online (accessed 2019) provide data on: *D. cortella* in Corsica, Sardinia and Italian mainland; *D. inscriptella* in Spain and France mainland, and Channel Is.; *D. dilutella* in all parts of Europe and everywhere in Italy. *Pempeliella matilella* was also recorded in Corsica and Sardinia (Leraut, 2001). Leraut (2014) provided distribution data on *Delplanqueia dilutella* and *D. inscriptella* illustrating the distribution on maps of Europe including the continental Italy without details and bibliographic references.

In the following text we reported the precise citations of our studied species mentioned in the past literature. The species *subornatella* and *dilutella* were attributed in the past to different genera *Pempelia* or *Pempeliella* or *Delplanqueia* by different collectors. For this reason and simplicity, here, we introduce these species without specifying the genus.

***subornatella* (Duponchel, 1837).**

VALLE D'AOSTA: *Pempelia subornatella*, Gressoney (Curò, 1880); Parco Mont Avic, 1 ♂, prati sopra Volla, 1500 m ca., 25.VII.1994 (lux); (Baldizzone, 1996). PIEMONTE: Terme di Valdieri, luglio-agosto, *Pempelia subornatella* Dup. (Turati E. and Verity R., 1911). Magnoni-sentiero per la Colma, 500-600 m, 21.V.2003. Colle degli Eremiti, 560 m, 7.IX.2005 (lux). La Benedicta, Cascina Moglioni, 800 m ca., 27.VIII.2003 (lux). Capanne inferiori, località Gli Olmi, 758 m, 10.VI.2003 (lux); 19.VI.2003 (lux); 8.VII.2003 (lux); 27.VIII.2003 (lux). Capanne superiori, sentiero per il Rio Lischeo, 850 m, 22.VII.2005. *Delplanqueia subornatella* (Duponchel, 1837) Sauter W. det. (Baldizzone *et al.*, 2013). TRENINO-ALTO ADIGE: Brennero, North and South (Hartig, 1956). Provincia di Bolzano, *Pempeliella subornatella* (Burmman, 1995). Venosta: Media Venosta 8.IX.(19)29, Laces-Latsch 30.VII, Latschander multiple moths. 1., 3. e 6.VI.(19)29 (Astfaller B. leg.); Juval frequent to light from the middle of V-VI, isolated from the middle of VIII-IX (Reitberger H. leg.); Stava-Staben 26.V.(19)30, Naturno-Naturns 1-24.V.34 (Astfaller B. leg.); *ibid.* freq. 12-15.IX.36 (Hartig F. leg.); 5.VI.51; Val d'Adige: Ora-Auer 12.IV.(19)53 (Kappeler R. leg., Burmann K. det.); Matarello, 1 ♂, 26.VIII.(19)28 and 19. IX.(19)33 (Perini T. leg.); Zona Gardesana: Nago, 1 ♀ 30.V.(19)30 (Dannehl F. leg.); Gardone 1 ♀ 16.VIII.1933 (Turati E. leg.); Val Sarca infer.; Val d'Isarco: Chiusa-Klausen, VI.(19)05 (Moebius E. leg.); Dolomiti: Val Popena (Mann J. & Roggenhofer A. leg.); (Hartig, 1958). FRIULI-VENEZIA GIULIA: Provincia di Trieste, *Pempeliella subornatella* (Burmman, 1995). EMILIA ROMAGNA: *Pempelia subornatella* Dup., S. Varano (FC), Gianelli G. det., Ladino (Forlì, FC), Gianelli G. det., maggio e agosto, (Zangheri P. leg.) (Zangheri, 1923, 1950). SICILIA: Casteldaccia e dintorni (PA), V-VII, *Pempelia subornatella* Dup. (Mariani, 1939).

***dilutella* (Denis & Schiffermüller, 1775).**

LOMBARDIA: *Pempelia adornatella*, giugno, Alzate (CO) (Turati 1879). PIEMONTE: Terme di Valdieri, luglio-agosto (Turati and Verity, 1911). Venaria R., 20.V.1930, boschi di Mirafiori, 20.V.1927 (Della Beffa, 1941). Valdieri, Riserva Speciale dello *Juniperus phoenicea*, 900 m ca., 11.IX.1998, 10.VII.1999, 12.VII.1999 (lux), *Pempeliella dilutella* (Denis & Schiffermüller, 1775); (Baldizzone, 2005). Campi della Marca, 630 m, 30.VI.2010 (lux); Colle degli Eremiti, 560 m, 31.V.2004; Sentiero per Cascina Nespolo, 600 m ca., 31.V.2002; Capanne inferiori, località I Foi, 770 m, 2.VII.2008 (lux); Capanne inferiori, località Gli Olmi, 758 m, 12.VII.2002 (lux); 9.VI.2003 (lux); 19.VI.2003 (lux) 27.VIII.2003

(lux); 14.VI.2004 (lux), *Delplanqueia dilutella* (Denis & Schiffermüller, 1775); (Baldizzone *et al.*, 2013). TRENINO-ALTO ADIGE: Brennero, N. e S. (Hartig, 1956). Venosta: Naturno-Naturns, at light, VI.(19)35 (Klimesch J. leg.); Sette Comuni: Lavarone VII.(19)33 (Anonymous collector); Brenta e Paganella: Pinzolo 3 ♂♂, 16. e 17.VIII.(19)26, ♂ 8, ♀ 14.VIII.(19)28 (Fiori A. leg.); Gruppo orientale: Tures-Taufers, not frequent (Weiler J. leg.); Val d'Adige: Terlano 1 ♂ 3.VI, 1 ♀ 2.VII, 2 ♂♂ 21.IX.(19)24 (Dannehl F. leg.); *ibid.* 23.V (Ostheleder L. leg.); S. Maurizio-Moritzing (Hellweger M. leg.); Castel Firmiano-Sigmundskron, 1 ♂, 21.VI, 7.VIII.(19)25 (Dannehl F. leg.); Bolzano (Mann J. leg.); Montagna-Montan 29.VIII.(19)54 (Kappeler R. leg., Burmann K. det.); S. Michele IX.(19)34 (Anonymous collector); Trento 1 ♂ 29.VI.(19)26 (Trener G.B. leg.); Matarello 14, 22 e 29.VI, 28.VIII, 8.IX.(19)28 e 8.VIII.(19)31 (Perini T. leg.); Val d'Isarco: Bressanone (Hellweger M. leg.); Ponte Isarco-Waidbruck (Schawerda K. leg.); Campodazzo-Atzwang 13.VI.54 (Burmman K. leg.); Zona gardesana: Eremitaggio-Torri, found isolated in VI.(19)40, S. Vigilio 1 ♀ 9.VIII.1942 (Hartig F. leg.); Alpi Sarentine: Collalbo-Klobenstein 1 ♂ 4.VII.(19)30, found isolated from the beginning of VI to the middle of VII.(19)47 (Hartig F. leg.); Avelengo-Hafling 12.VII.(19)31 (Hager K. leg.); (Hartig, 1958). Provincia di Bolzano, *Pempeliella dilutella*=*adornatella* (Burmman, 1995). *Pempeliella dilutella*, Pomarolo (TN) (Huemer, 2002). Neumarkt (Egna) (BZ), Kurtinig (Cortina) (BZ) (Huemer, 2004). FRIULI-VENEZIA GIULIA: Provincia di Trieste, *Pempeliella dilutella*=*adornatella* (Burmman, 1995). Alesso and Tagliamento (Udine), *Pempeliella dilutella* (Deutsch, 2006). Area of the Dealpine rivers Meduna and Tagliamento (Friuli-Venezia Giulia, northern-Italy), *Pempeliella dilutella* (Huemer, 1997). 1 ♂, (gen. praep. Fazekas I., No. 2722), Carso Goriziano, Marcottini (GO), 6.VI.1989, Morin L. leg (Fazekas, 1996). VENETO: Valle Vecchia di Caorle, Venezia, *Pempeliella dilutella* (Denis & Schiffermüller, 1775), (Huemer and Morandini, 2008). UMBRIA: San Faustino (TR), Narni (TR), *Pempeliella dilutella* (Pinzari *et al.*, 2010). 1 ♀, Assisi (PG), Colcaprile, Via Mosciole, 450 m, 21.V.2005, Zerunian Z. & I. leg. 1 ♂, Monte Subasio (PG), Mortaro Grande, 1200 m, 16.VI.2015 (gen. praep. PIRA 330, M. Pinzari), Zerunian Z. leg, *Pempeliella dilutella* (Pinzari *et al.*, 2016a). LATIUM: *Pempelia dilutella*, Fondi, S. Anastasia, 1 ♂, 1-12.VIII, Predota C. leg (Hartig, 1939). Cittaducale (RI), Cardito, Prola C. leg.; Monte Cagno e dintorni, Borbona (RI) Fraz. Vallemare, località Colle Marcone, 1121 m, Pian Mattano, 1100 m, Posta (RI), Fraz. Villa Camponeschi, località Colle Petruccio, 1000 m (Pinzari *et al.*, 2010). Tenuta Presidenziale di Castelporziano (RM), *Pempeliella dilutella* (Pinzari *et al.*, 2017a). EMILIA ROMAGNA: località Bosco di Ladino (Forlì, FC), August, *Pempeliella dilutella* Hb., Turati E. det., Zangheri P. leg (Zangheri, 1923, 1950). *Pempelia dilutella* Hb., Perino (Frazione di Coli, PC), 19.IX (Roberti *et al.*, 1965). CALABRIA: Contrada Li Rocchi, Rende (CS), 205 m, 14.V.2014, *Delplanqueia dilutella* (Scalcio, 2016). SARDINIA: Santoru, 8.VI; Aritzo, 4-20.VII; Belvi, 6.VIII; Desulo, 7.VII, *Pempelia dilutella*; (Hartig and Amsel, 1951). SICILY *Pempelia dilutella*, V. VIII (Mariani, 1939). Mistretta, Monte Neviera, *Pempelia dilutella* (Zerny, 1943).

***Pempelia cortella* (Constant, 1884).**

SARDINIA: Sa Casa 24-29.VII; Aritzo 9-27.VII; Piano di Sadali 5.VII; Strada per Desulo 8.VII. *Pempelia cortella* Const. (Hartig and Amsel, 1951).

***Pempeliella matilella* Leraut, 2001.**

SARDINIA: Paratypes: 1 ♂, Italie, Sardaigne, Aritzo, "dint. Cant. Sa Casa", 950 m, 24.VII.36 (conte F. Hartig) (gen. praep. Leraut P., n° 6639; MNHN, Paris); trois femelles, memes coordon-

nees, une femelle, Sardaigne, 3.VIII.1936 (H.G. Amsel); (Leraut, 2001).

Material examined and species identification

We studied the specimens from central Italy in the collections ("coll." hereafter) of Maltzeff P. (Rome, at present, it is included in Pinzari collection), Pinzari (Rome) and Zerunian (Assisi), and from other Italian localities in the collections of Prola C. and Hartig F. preserved respectively in Museo civico di Zoologia di Roma ("MCZR" hereafter) and Museo di Zoologia dell'Università la Sapienza di Roma ("MZUR" hereafter).

For the taxonomic identification, specimens were identified either after external habitus and by dissections of the genitalia using characters reported by Leraut (2001) and recent authors (Buhl *et al.*, 2016; Schmid, 2016; Plant *et al.*, 2017; Sloomackers *et al.*, 2018). Genital parts were glycerol-preserved into microtubes whose ends were closed with vinyl glue easily soluble in water: the microtubes were put under the specimens themselves. For the species identification based on habitus, we took into account wing colour, pattern and wingspan ("wingspan", "WS" hereafter) of each specimen. For the study of genital parts, we calculated: in males, the ratio between the lengths of *cornutus* and *aedeagus* ("CA ratio" hereafter); in females, the ratio between the length of the short and the long *signa* bands ("S ratio" hereafter), and the mutual position of the two genital structures. The genitalia features were directly measured on photographs which we expressed in percentage (Table 1). They were compared between *inscriptella* and *dilutella*, using a Mann-Whitney U test.

To verify the relationship between the ancient specimens of museum collections and the past literature, we recorded the collo-

cation ("colloc." hereafter) of the species (Hartig's collection, boxes no. 17a and 18a; Prola's collection, original collocation unknown) and the presence of determination cards under the specimens. After our study, all specimens of the collection of F. Hartig (MZUR) and C. Prola (MCZR) have been returned to the museums and placed in a new collocation on basis of our species determination. We added another ID card under the original card to each specimen.

To show an updated distribution of *Delplanqueia* group in Italy, we mapped the collecting sites of the examined material showing also the localities of specimens cited in literature but for which it was not possible to examine the moths.

Results

During our study, we identified correctly the species and grouped the specimens following the recent determination by Leraut (2001). All specimens of *Pempeliella subornatella* Duponchel, 1837 were identified as *Delplanqueia dilutella* (Denis & Schiffermüller, 1775) and all specimens of *Pempeliella dilutella* (Denis & Schiffermüller, 1775) were classified as *Delplanqueia inscriptella* (Duponchel, 1836). Below is the list of the studied specimens grouped according to the new determination.

Delplanqueia dilutella (Denis & Schiffermüller, 1775).

LOMBARDIA: 1 ♂ (gen. praep. PIRA 469, M. Pinzari), Italia sept. (Monte Bisbino (CO), 15.VI.1908, coll. Kruger, with label of species determination "*Pempelia subornatella* Dup., Kruger Geo. C." (MCZR). PIEMONTE: 1 ♂ (gen. praep. PIRA 492, M. Pinzari), colloc. in *subornatella*, Piemonte, Alpi Cozie, Oulx, 14.VIII.1936 (legit absent), (MZUR). 1 ♂ (gen. praep. PIRA 523, M. Pinzari),

Table 1. Species identification based on habitus and genitalia features.

Regions	Male						Female					
	WS (mm)			CA ratio (%)			WS (mm)			S ratio (%)		
	Mean	Range	N.	Mean	Range	N.	Mean	Range	N.	Mean	Range	N.
<i>Delplanqueia dilutella</i> (Denis & Schiffermüller, 1775)												
Lombardia	20	20	1	76	76	1	-	-	0	-	-	0
Piemonte	19	19	2	86	80-92	2	-	-	0	-	-	0
Trentino A. Adige	20	18-22	9	70	59-82	9	18	16-20	2	54	53-55	2
Veneto	20	19-20	2	82	63-100	2	19	19	1	64	64	1
Umbria	19	19	1	79	79	1						
Lazio (Vallemare)	20	19-21	2	79	77-81	2	19	18-19	3	54	52-57	3
Sicilia	22	22	1	72	72	1	-	-	0	-	-	0
All regions	20	18-22	18	75	59-100	18	18	16-20	6	56	52-64	6
<i>Delplanqueia inscriptella</i> (Duponchel, 1836)												
Liguria	21	21	1	113	113	1	-	-	0	-	-	0
Trentino A. Adige	18	17-19	3	108	100-119	3	19	17-20	5	68	60-79	5
Lazio (Vallemare)	19	17-20	26	101	100-117	26	17	16-19	9	71	66-80	9
Lazio (other localities)	18	17-20	9	107	100-118	7	16	15-16	2	71	67-75	2
Umbria	20	17-21	7	101	100-102	6	-	-	0	-	-	0
Sicilia	20	20	1	110	110	1	-	-	0	-	-	0
Sardegna	19	17-21	5	99	85-109	5	17		1	71		1
All regions	19	17-21	49	105	85-119	49	18	15-20	17	70	60-80	17

WS, wingspan; CA ratio, the ratio between the lengths of *cornutus* and *aedeagus*; S ratio, the ratio between the length of the short and the long *signa* bands.

Italy Albarasca di Stazzano, 18.VIII.(19)82, E. Berio leg. (MCZR); VENETO: 1 ♂ (gen. praep. PIRA 475, M. Pinzari), colloc. in *dilutella*, Lago di Garda, Torri Benaco, 2.VI.40; 1 ♀ (gen. praep. PIRA 500, M. Pinzari), colloc. in *P. dilutella*, idem, 6.VI.1940, 1 ♂ (gen. praep. PIRA 501, M. Pinzari), colloc. in *P. dilutella*, idem, 8.VI.1940; 1 ♀ (gen. praep. PIRA 472, M. Pinzari), colloc. in *P. dilutella*, Lago di Garda, San Vigilio, 9.VIII.(19)42, Hartig leg (MZUR). TRENTINO-ALTO ADIGE: 1 ♂ (gen. praep. PIRA 486, M. Pinzari), colloc. in *P. subornatella*, Trentino, Gardone, 17.VIII.1936, coll. Cte. Hartig (MZUR); 1 ♂, (gen. praep. PIRA 510, M. Pinzari), colloc. in *P. subornatella*, Val Venosta, Naturno, 550 m, 1.V.1934, 4 ♂♂ (gen. praep. PIRA 484, PIRA 508, PIRA 509, PIRA 511, M. Pinzari), colloc. in *subornatella*, idem, 21.V.1934, 1 ♂ (gen. praep. PIRA 512, M. Pinzari), colloc. in *subornatella*, idem, 12-15.IX.1936, 1 ♂ (gen. praep. PIRA 483, M. Pinzari), colloc. in *subornatella*, idem, 15.IX.1936, coll. Cte. Hartig (MZUR). 1 ♂ (gen. praep. PIRA 494, M. Pinzari), colloc. in *P. subornatella*, Matarello, Trento, Italia, 19.IX.1933, 1 ♀ (gen. praep. PIRA 489, M. Pinzari), colloc. in *P. subornatella*, idem, 25-31.X.1936, T. Perini leg (MZUR). UMBRIA: 1 ♂ (gen. praep. PIRA 524, M. Pinzari), Orvieto, S. Faustino, 4.VIII.58 (1958), Prola C., (MCZR). LATIUM: Vallemare (RI), 1 ♂, Colle Marcone, 1121 m, 13.V.2011 (gen. praep. PIRA 279, M. Pinzari), M. Pinzari leg., 1 ♀, (gen. praep. PIRA 528, M. Pinzari); Lazio dint. di Posta(RI), Villa Camponeschi, località Colle Petruccio, 1000 m, 1-8.VIII.2001, 1 ♀, (gen. praep. PIRA 526, M. Pinzari), idem, 25.VIII.2001, 1 ♂, (gen. praep. PIRA 525, M. Pinzari), idem, 20.VIII.2002, A. Zilli leg., (MCZR). ABRUZZO: 1 ♂, Abruzzo, Magliano dei Marsi, 700 m, Prola C., 26.V.(19)80 (MCZR). SICILIA: 1 ♂ (gen. praep. PIRA 485, M. Pinzari), colloc. in *subornatella*, Sicilia, Palermo, 4.VIII.193(sic!), Dannehl F. leg. (MZUR).

Delplanqueia inscriptella (Duponchel, 1836).

LIGURIA: 1 ♂ (gen. praep. PIRA 470, M. Pinzari), colloc. in *cortella*, Alpi Marittime, Carmo Langan, 14.VIII.(19)50, Prola C. leg. (MCZR). TRENTINO ALTO-ADIGE: 1 ♀ (gen. praep. PIRA 507, M. Pinzari), colloc. in *dilutella*, Collalbo, Bolz, 1200 m, 14.VI.1947, 2 ♀♀ (gen. praep. PIRA 473, PIRA 495, M. Pinzari), colloc. in *dilutella*, idem, 16.VI.(19)47, 1 ♂ (gen. praep. PIRA 474, M. Pinzari), 1 ♀ (gen. praep. PIRA 506, M. Pinzari), Colloc. in *dilutella*, idem, 16.VII.(19)47; Hartig F. leg. (MZUR). 1 ♂, (gen. praep. PIRA 504, M. Pinzari), colloc. in *dilutella*, Matarello, Trento, Italia, 8.VIII.(19)31, 1 ♂, (gen. praep. PIRA 505, M. Pinzari), colloc. in *dilutella*, idem, 1-5.VIII.1936, 1 ♀ (gen. praep. PIRA 481, M. Pinzari), colloc. in *dilutella*, idem, 25-31.8.1936, Perini T. leg. (MZUR). UMBRIA: 1 ♂ (gen. praep. PIRA 471, M. Pinzari), colloc. in *dilutella*, Umbria, Narni, VIII.56, 2 ♂♂ (gen. praep. PIRA 467, PIRA 533, M. Pinzari), 4.9.(19)58, 1 ♀, idem, 15.IX.(19)58, Prola C. leg; 1 ♂ (gen. praep. PIRA 532, M. Pinzari), Orvieto, 5.VIII.(19)52, Prola C. leg; (MCZR). 1 ♂, Monte Subasio (PG), Mortaro Grande, 1200 m, 16.VI.2015 (gen. praep. PIRA 330, M. Pinzari), 1 ♂ (gen. praep. PIRA 420, M. Pinzari), idem, 10.VI.2017, Zerunian Z. leg., 1 ♂ (gen. praep. PIRA 498, M. Pinzari), Assisi (PG), località Colcaprile Via Mosciola, 450 m, 21.V.2005, Zerunian Z & I. leg. LATIUM: 1 ♀, colloc. in *dilutella*, Cittaducale (RI), Cardito, 18.V.(19)49, 1 ♂, idem, 14.IX.(19)49, 1 ♂ (gen. praep. PIRA 468, M. Pinzari), idem, 15.9.(19)50, 1 ♂, idem, 25.IX.(19)58, Prola C. leg (MCZR). 1 ♂ (gen. praep. PIRA 476, M. Pinzari), colloc. in *dilutella*, Lazio, Palo (RM), 24.V.(19)40, Hartig F. leg (MZUR). 1 ♂ (gen. praep. PIRA 479, M. Pinzari), colloc. in *dilutella*, Lazio, Fondi (LT), S.ta Anastasia, 3-12.VIII.1937, Predota C. leg (MZUR). 2 ♂♂, Lazio, dint. di Posta (RI), Villa Camponeschi, località Colle Petruccio, 1000 m, 20.VIII.2002, 1 ♂ (gen. praep. PIRA 529, M. Pinzari), idem,

25.VIII.2002, 1 ♂ (gen. praep. PIRA 527, M. Pinzari), 1 ♀ (gen. praep. PIRA 531, M. Pinzari), idem, 26.VIII.2002 (MCZR), Zilli A. leg. Vallemare, Borbona (RI), 1 ♂ (gen. praep. PIRA 3, M. Pinzari), Colle Marcone, 1121 m, 22.VII.1989, 1 ♂ (gen. praep. PIRA 449, M. Pinzari), Colle Marcone, 1121 m, 5.VIII.1989, 1 ♂, idem, 10.VIII.1989, 1 ♂ (gen. praep. PIRA 451, M. Pinzari), idem, 25.VIII.1989, 2 ♂♂, (gen. praep. PIRA 442, PIRA 458, M. Pinzari), idem, 27.VI.1998, 1 ♂, (gen. praep. PIRA 55, M. Pinzari), idem, 5.VII.1997, 2 ♂♂, idem, 5.VIII.2003, 2 ♀♀, idem, 7.VIII.2003, 1 ♂, idem, 8.VIII.2003, 1 ♂, idem, 18.VIII.2003, 1 ♂, (gen. praep. PIRA 466, M. Pinzari), idem, 2.VIII.2005, 1 ♀, idem, 11.VIII.2005, 2 ♂♂, (gen. praep. PIRA 438, PIRA 446, M. Pinzari), idem, 12.VIII.2005, 1 ♂, idem, 16.VIII.2005, 1 ♂, idem, 18.VIII.2005, 1 ♂ (gen. praep. PIRA 439, M. Pinzari), idem, 20.VIII.2005, 2 ♂♂, idem, 25.VIII.2005, 1 ♂ (gen. praep. PIRA 439, M. Pinzari), 1 ♀ (gen. praep. PIRA 16, M. Pinzari), idem, 26.VIII.2005, 1 ♂, idem, 30.VIII.2005, 1 ♀, idem, 16.VI.2006, 1 ♂, idem, 22.VIII.2006 (gen. praep. PIRA 26, M. Pinzari), 2 ♂♂, 1 ♀, idem, 3.IX.2006, 1 ♂, idem, 2.IX.2006, 2 ♂♂ (gen. praep. PIRA 454, M. Pinzari), idem, 3.IX.2006, 1 ♀, idem, 7.VII.2007, 2 ♂♂ (gen. praep. PIRA 456, M. Pinzari), idem, 8.VIII.2007, 1 ♂ (gen. praep. PIRA 452, M. Pinzari), idem, 11.VIII.2007, 2 ♂♂ (gen. praep. PIRA 445, M. Pinzari), idem, 14.VIII.2007, 1 ♀ (gen. praep. PIRA 463, M. Pinzari), idem, 15.VIII.2007, 1 ♀ (gen. praep. PIRA 459, M. Pinzari), idem, 16.VIII.2007, 1 ♂, idem, 17.VIII.2007, 1 ♂, idem, 29.VIII.2007, 1 ♂, idem, 28.V.2008, 2 ♂♂ (gen. praep. PIRA 99, PIRA 455, M. Pinzari), idem, 20.VI.2008, 1 ♀ (gen. praep. PIRA 465, M. Pinzari), idem, 6.IX.2008, 1 ♀, idem, 3.VI.2009, 1 ♂ (gen. praep. PIRA 185, M. Pinzari), idem, 13.VI.2009, 1 ♂ (gen. praep. PIRA 457, M. Pinzari), idem, 28.VI.2009, 2 ♂♂, (gen. praep. PIRA 447, M. Pinzari), idem, 20.VII.2009, 1 ♀, idem, 16.VIII.2009, 1 ♀, idem, 19.VIII.2009, 1 ♀, idem, 22.VIII.2009, 1 ♀, (gen. praep. PIRA 464, M. Pinzari), idem, 26.IX.2009, 1 ♀, idem, 10.VII.2010, 1 ♂, idem, 23.VII.2010, 1 ♂, idem, 1.VIII.2010, 2 ♀♀, (gen. praep. PIRA 462, M. Pinzari), idem, 20.VIII.2010, 1 ♂, idem, 13.V.2011 (gen. praep. PIRA 279, M. Pinzari), 1 ♀, idem, 8.VII.2011, 1 ♀, (gen. praep. PIRA 460, M. Pinzari), idem, 17.VIII.2011, 1 ♀, idem, 18.VIII.2011, 1 ♂, (gen. praep. PIRA 260, M. Pinzari), idem, 3.VIII.2012, 1 ♂, idem, 13.VIII.2012, 1 ♂, (gen. praep. PIRA 269, M. Pinzari), idem, 16.IX.2012, 1 ♂, idem, 19.VI.2013, 1 ♂, (gen. praep. PIRA 444, M. Pinzari), idem, 22.VIII.2013, 1 ♂, (gen. praep. PIRA 453, M. Pinzari), idem, 20.IX.2013, 1 ♀, idem, 28.IX.2013, 1 ♂, idem, 2.VI.2014, 1 ♂, idem, 5.VII.2014, 1 ♂, idem, 24.VIII.2015, 1 ♂, idem, 28.VIII.2015, 1 ♂, (gen. praep. PIRA 448, M. Pinzari), idem, 6.IX.2015, 2 ♂♂, idem, 19.IX.2015, 1 ♀, (gen. praep. PIRA 441, M. Pinzari), idem, 1.VII.2016, 2 ♂♂, (gen. praep. PIRA 443, M. Pinzari), idem, 24.VIII.2016, 1 ♀, (gen. praep. PIRA 461, M. Pinzari), idem, 19.VIII.2017, 1 ♂, idem, 25.VIII.2017; 1 ♂, (gen. praep. PIRA 450, M. Pinzari), 1 ♀, Pian Mattano, 1100 m, 28.V.2017; 1 ♂, Pian Zeidenti, 1300 m, 6.VI.2014; Pinzari M. leg. Roma litorale: Tenuta Presidenziale di Castelporziano (RM), 1 ♂, at Bufolareccia: Casale dei Contumaci, La Fornace, 30.V-5.VI.2006, (gen. praep. PIRA 352, M. Pinzari), 1 ♂ (gen. praep. PIRA 346, M. Pinzari), 1 ♀, Fontanile and Centro Inanellamento Tor Paterno, 12-17.VII.2006, 1 ♀ (gen. praep. PIRA 360, M. Pinzari), idem, 13-18.IX.2006, 1 ♂, idem, 18-22.IX.2006, (gen. praep. PIRA 349, M. Pinzari), 1 ♀ (gen. praep. PIRA 357, M. Pinzari), idem, 22-27.IX.2006; Maltzeff P. leg. SARDINIA: 1 ♂ (gen. praep. PIRA 503, M. Pinzari), colloc. in *dilutella*, Sardegna centrale, Aritzo (NU), 7.VII.1936, 1 ♂ (gen. praep. PIRA 502, M. Pinzari), colloc. in *dilutella*, idem, 8.VII.1936, 1 ♂ (gen. praep. PIRA 480, M. Pinzari), colloc. in *dilutella*, idem, 9.VII.1936, 1 ♂ (gen. praep. PIRA 477, M. Pinzari), colloc. in *dilutella*, idem,

20.VII.1936; 1 ♂ (gen. praep. PIRA 496, M. Pinzari), colloc. in *dilutella*, Sardegna centrale, Isili, 29.VII.1936; C.te Hartig F. leg. (MZUR); 1 ♀ (gen. praep. PIRA 482, M. Pinzari), colloc. in *dilutella*, Ct. Fontanamela, 770 m, 3-4.VIII.1936; Hartig F. leg. (MZUR). SICILY: 1 ♂ (gen. praep. PIRA 478, M. Pinzari), colloc. in *dilutella*, Sicilia, Zappulla (ME), 6.VI.1935, Mariani M. & Hartig F, leg. (MZUR).

Distinguishing the species

Males

In both species, the *phallus* consists of a long cylindrical *aedeagus* with projecting fingers and a *vesica* with one large *cornutus*. When the *vesica* is everted and the *cornutus* is clearly visible (Figure 1A) the *cornutus* is of about equal length to the *aedeagus* in *D. inscriptella* whereas in *D. dilutella* (Figure 1B) it tends to be shorter. The values of *CA* ratio in *dilutella* were on average equal to 75 ± 10 % (Mean value \pm *SD*; Range: 59 to 100 %) and in

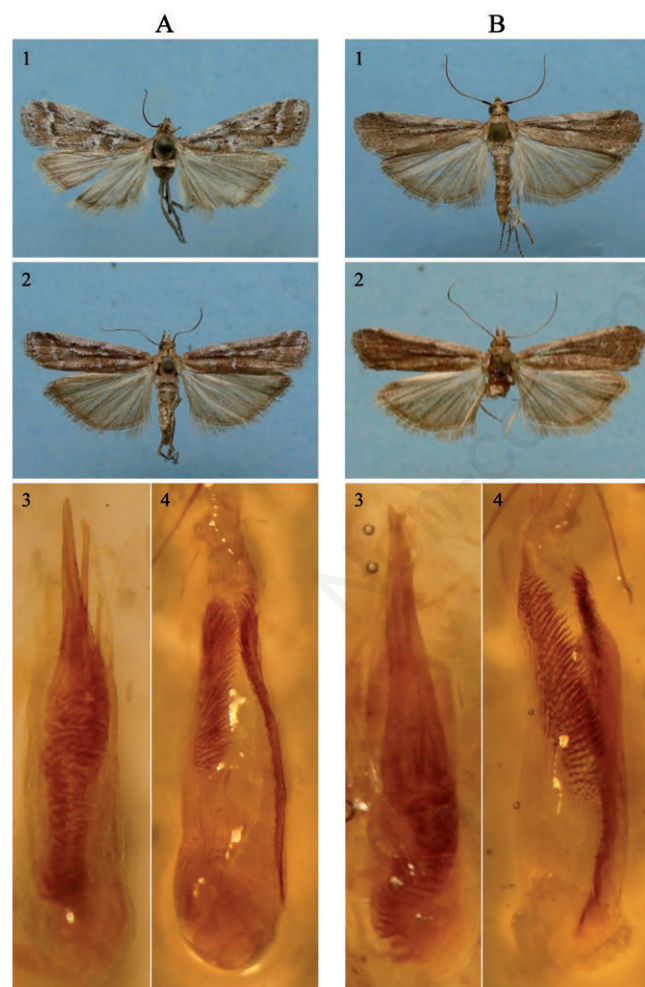


Figure 1. *Delplanqueia dilutella* (A): 1-3) Lazio, PIRA 279 ♂, wingspan 21 mm; 2-4) Trentino Alto Adige, PIRA 489 ♂, wingspan (WS) 20 mm. *Delplanqueia inscriptella* (B): 1-3) Sardinia, PIRA 503 ♂, WS 18 mm; 2-4) Sardinia, PIRA 482 ♂, WS 17 mm.

inscriptella to 105 ± 6 % (Range: 85 to 119 %) when considering all specimens together. *D. inscriptella* showed higher values of *CA* ratio than *dilutella* (Mann-Whitney U test, *CA* ratio, $N_{inscriptella}=49$, $N_{dilutella}=18$, $U=10.00$, $Z=6.10$, $P<0.0001$).

As the wingspan concerns, the values of WS *dilutella* males were on average equal to 20.00 ± 1.19 mm (Mean value \pm *SD*; Range: 18 mm to 22 mm) and in *inscriptella* to 18.84 ± 1.18 mm (Range: 17 to 21 mm) when considering all specimens together. *Delplanqueia dilutella* showed higher values of WS than *inscriptella* (Mann-Whitney U test, *wingspan*, $N_{inscriptella}=49$, $N_{dilutella}=18$, $U=230.50$, $Z=-2.98$, $P<0.0001$). When grouping the males for regions and for localities in which the two species are sympatric, such as Vallemare, the results showed variability in *CA* ratio and WS and therefore an overlap of morphological data between the studied species (Table 1).

Females

In both species, females have a pair of *signa* in the *corpus bursae* (Figure 1). These have different lengths and the values of their ratio (*S* ratio) in *Delplanqueia dilutella* were on average equal to 55.77 ± 4.37 % (Range: 52 to 64%) and in *D. inscriptella* to 70 ± 5.3 % (Range: 60 to 80 %) when considering all specimens together. *D. inscriptella* showed higher values of *S* ratio than *dilutella* (Mann-Whitney U test, *S* ratio, $N_{inscriptella}=17$, $N_{dilutella}=6$, $U=2.00$, $Z=3.43$, $P=0.0006$). Females show a similar wingspan ($WS_{dilutella}=18.50 \pm 1.38$ mm, $N=6$; $WS_{inscriptella}=17.59 \pm 1.54$ mm, $N=17$; Mann-Whitney U test, NS).

Distribution of the studied specimens in Italy

The distribution map of the studied specimens revealed that the North and especially the Northern East Italy was studied a lot in the past by several collectors (Hartig 1958, Figure 2) and the prevailing species in this area was *D. dilutella*; this species therefore was recorded in Piedmont and Lombardy, and also in Abruzzo.

As *D. inscriptella* concerns, it was recorded mainly in Central Italy and Sardinia. In Sicily we examined only two specimens, one attributed to *D. dilutella* (Palermo, Hartig's collection (MZUR) and the other to *D. inscriptella* (Zappulla, ME). As the entomological card under the specimen from Palermo reveals (Figure 1, right), the original collector was Mariani but it was changed in Dannehl and unfortunately the collecting year is incomplete, i.d., 193 (sic!).

Delplanqueia dilutella and *D. inscriptella*, while in some localities they live separately (e.g., Liguria and Sardinia, *D. inscriptella*), in others were coexistent as in Trentino (at Mattarello (sic!)), in Umbria and Latium (at low altitude). In Latium, precisely at Vallemare (RI), *D. dilutella* and *D. inscriptella* live together however the first seems an elusive species and is little attracted to lamp (Mario Pinzari, personal observation). As evidence of this, in Pinzari's collection there are 59 ♂♂ and 25 ♀♀ of *D. inscriptella* and a single of *D. dilutella* (Figure 1). They were collected from 1989 to 2017 in the context of a wide ongoing survey on lepidoptero fauna (Pinzari, 2009, 2016a, 2016b; Pinzari and Sbordoni, 2013; Pinzari *et al.*, 2013, 2015, 2016b, 2017b, 2018, 2019).

Therefore, we did not find any specimen attributable to *Delplanqueia cortella*. The historical specimens collected by Hartig in Sardinia were collected in the same localities and dates mentioned by Hartig and Amsel (1951) and were placed in Hartig's collection (MZUR) as *cortella*. After our study, all are identified as *Pempeliella matilella* (Leraut, 2001).

Discussion

Our study revealed that all specimens identified in the past as *Pempeliella subornatella* were *Delplanqueia dilutella* and *Pempeliella dilutella* were *Delplanqueia inscriptella*.

The original collocation of the studied specimens in Hartig's collection (MZUR) showed that both Hartig and his contemporary entomologists were able to well distinguish the species belong to the studied group without the examination of genitalia. On the basis of habitus, it is indeed possible to recognize *dilutella* from *inscriptella* (Figure 1). The wing pattern of fresh males of *D. dilutella* is like that typical of *subornatella* illustrated by Slamka (1997). The wings background colour of *inscriptella* is always characterized by a more or less strong presence of pompeian red, turned to brick red in the historical specimens (Figure 1); this is even in the specimens with a more marked design. Therefore, light scales in *dilutella* are very widespread even outside of the lines of wing design; the scales are white in *dilutella* while gray colored in *inscriptella*.

Genitalia and especially the lengths of *cornutus* and *aedeagus* that are similar in *inscriptella* e significantly shorter in *dilutella*, as illustrated or explicitly mentioned by different authors (Leraut,

2001; Buhl *et al.*, 2016; Schmid, 2016; Plant *et al.*, 2017; Sloomackers *et al.*, 2018), support and confirm the determination of the species. The variability of the genital features (*e.g.*, *CA* ratio), indicates that the criterion cannot be applied to a single individual but it could be valid only applying to on an adequate number of specimens from the same locality (see, for example, the data from Vallemare in Lazio, Table 1, Figure 1). As wingspan concerns, in European populations, WS of *inscriptella* is on average larger than *dilutella* (Leraut, 2001; Buhl *et al.*, 2016), while in Italian populations it is exactly the inverse (Table 1). Females of the two species have similar wingspan and are smaller than males. For the determination of females on the basis of the habitus, the same criteria as those of the males apply. However, if the specimens under the study are females, it is easier to make mistakes in the identification of the species, because the differences between species are more attenuated in females (Figure 1).

According to different authors, the ratio between the lengths of *signa* seems to be decisive for identifying the species but also in this case this characteristic is actually valid in the determination of the species comparing large samples from the same natural population and less useful for the examination of few individuals (Table 1). Neither the amplitude of *signa* is a good and convincing diagnostic

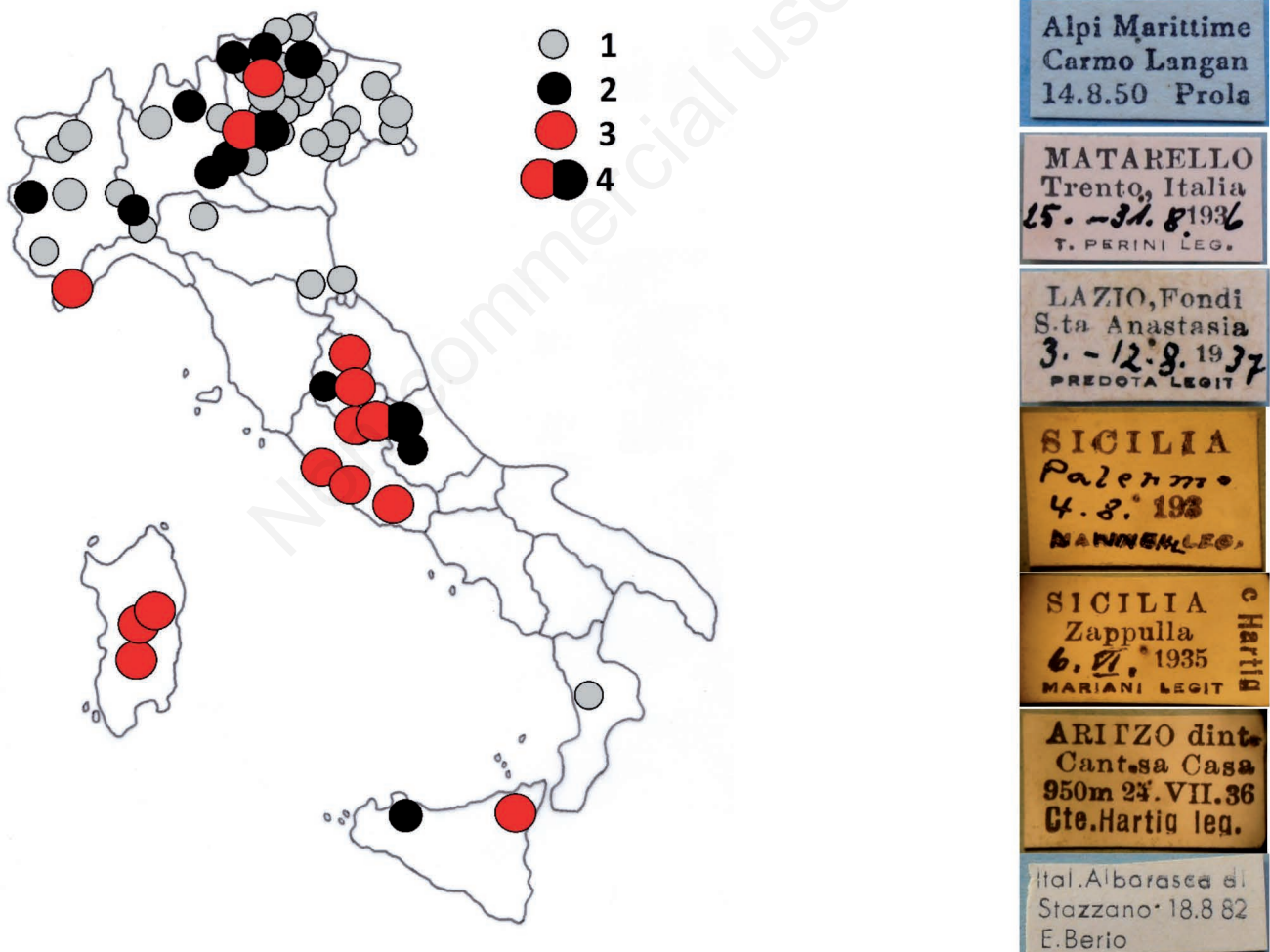


Figure 2. Distribution of the genus *Delplanqueia* in Italy after our study: 1) unverified quotations; 2) *D. dilutella*; 3) *D. inscriptella*; 4) *D. dilutella* and *D. inscriptella*. On the right we show some historical entomological cards (from top to bottom) by C. Prola; T. Perini; C. Predota; F. Dannehl; M. Mariani; F. Hartig; E. Berio.

character (Figure 1) due to the wide variability of female genital features. Our experience suggests that, in addition to the length of the two *signa*, it is important to observe their mutual position. Leraut (2001), and recently Buhl *et al.* (2016) illustrated female genitalia of *inscriptella* with crossed *signa* while *dilutella* with parallel *signa*. We have indeed observed that in all studied specimens of *inscriptella* the end of the longer *signa* twists on the other shorter; in other words, the two *signa* appear skewed and crossed to the observer. This feature is always present even in the cases where the ratio between the *signa* leaves some doubts. In *dilutella* the two ends of *signa* instead do not roll up. Thus, the mutual position of *signa* and S ratio may be good diagnostic features but not considered alone.

Also, the specimens placed in *Pempeliella cortella* in Hartig's collection were well determined by Hartig as different from the other two species but were classified as *Delplanqueia matilella* (Pinzari and Pinzari, 2019). Of five Italian paratypes of *D. matilella* 1 ♂ and 3 ♀♀ were collected by Hartig and 1 ♀ by Amsel in Sardinia and preserved by Leraut (2001). In the Hartig's collection (MZUR) is preserved a good sample of 27 specimens with collocation under *D. cortella* that we examined. The jagged antennae of male, the totally different genitalia and the habitus leave no doubts about the determination of the species: *D. matilella*. The sample site of all specimens and almost all the sampling dates coincide with the paratypes. Accordingly, we can say with certainty that the quote about *D. cortella* by Hartig and Amsel (1951) for Sardegna concerned *D. matilella*, later described by Leraut (2001).

Hartig and Amsel (1951) also mentioned the presence of *Pempelia dilutella* in Sardinia at the localities and dates: Aritzo 4-20.VII; Santoru 8.VI; Belvi 6.VIII; Desulo 7.VII. We examined 1 ♂ from Aritzo, 9.VII.1936 in Hartig's collection with collocation under *P. dilutella*. Our study revealed that this specimen was *D. inscriptella*. Also, other two males and a female placed in *P. dilutella* from Isili and Ct. Fontanamela are *D. inscriptella* on basis of their habitus (short wingspan: ♂, 18.6 mm; ♀, 17 mm) and genitalia (Table 1, Figure 1).

As the distribution in Italy concerns, Hartig (1958) already pointed out that *D. dilutella* (ex *subornatella*) was spread from the valleys up to the middle mountain in two generations in May-June and then isolated in August-September; it was very isolated on the other hand in the Oltrebrennero area ("era diffusa dalle valli fino alla media montagna in due generazioni nel V-VI e poi isol(ate) nella VIII-IX. Molto isolate invece nel settore dell'Oltrebrennero", Hartig, 1958). About *D. inscriptella* (ex *dilutella*), the author writes "somewhat more diffuse but less frequent, in two generations from the end of May to the beginning of July and from August-September, often attracted to the lamp" ("alquanto più diffusa ma meno frequente, in due generazioni dalla fine V - principio VII e dall'VIII - IX, spesso al lume", Hartig, 1958).

These observations concerning Trentino Alto Adige are clearly confirmed in the map of Figure 2, as further proof that the specimens examined are part of those used by Hartig for his publication in the 50s (Hartig, 1958). In this work, it is interesting the note on *inscriptella* that this moth often comes to light because it confirms our observations in Vallemare; here, we collected indeed at the lumen dozens of *inscriptella* and only one *dilutella*. This fact let us suppose that even *dilutella* is more widespread in Italy than it seems.

Conclusions

We revealed the presence in Italy of two species of the genus *Delplanqueia* Leraut, 2001: *dilutella* and *inscriptella*. Our findings showed that *cortella* is not present in Sardinia and the specimens

cited by Hartig were *Pempeliella matilella* (Pinzari and Pinzari, 2019). *D. dilutella* is quite common in northern Italy but also in the center and in Sicily. *D. dilutella* is very elusive, perhaps not very attracted to light. *D. inscriptella* is present in Liguria and in Trentino Alto Adige, clearly more widespread in the center of Italy, also in Sicily and Sardinia. In Latium (Vallemare) and in Trentino Alto Adige (Matarello) the two species coexist in the same environment.

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