

LUPINUS BICOLOR LINDL. (FABACEAE), A NEW SPECIES FOR THE PALEARCTIC VASCULAR FLORA

Rogelio SÁNCHEZ-VILLEGAS^{1*}, Marcial ESCUDERO² & Modesto LUCEÑO¹

¹ Department of Molecular Biology and Biochemical Engineering. Botany area. University Pablo de Olavide de Sevilla. Ctra. de Utrera, km 1. 41013-Sevilla. rogelinsanville@gmail.com

² Department of Plant Biology and Ecology. University of Sevilla. Avda. Reina Mercedes s/n. 41012-Sevilla

ABSTRACT: In the present paper, *Lupinus bicolor* Lindl., a plant native to SW North America, is cited for the first time to the Palearctic region. The populations of this species were found in Sierra de Gredos, where they grow mainly in temporarily flooded spring meadows in *Quercus pyrenaica* Willd. domain. After a morphological study of the specimens, we have not found any morphological differences between the Gredos and the American continent populations. The presence of *L. bicolor* in the Iberian Peninsula is probably the result of a human introduction, although more in-depth studies are necessary to completely rule out the natural origin of these populations. **Keywords:** *Lupinus bicolor*; Palearctic region; chorology; Sierra de Gredos, Spain.

RESUMEN: *Lupinus bicolor* Lindl. (*Fabaceae*), nueva especie para la flora vascular paleártica. En el presente artículo damos a conocer por primera vez la presencia en el Viejo Mundo de *Lupinus bicolor* Lindl., una planta nativa del SO de Norteamérica. Las poblaciones han sido halladas en la sierra de Gredos, donde crecen principalmente en prados primaverales temporalmente inundados del dominio de *Quercus pyrenaica* Willd. Tras un estudio morfológico, no hemos encontrado ninguna diferencia entre las poblaciones gredenses y las del continente americano. La presencia de *L. bicolor* en la península ibérica es probablemente el resultado de una introducción humana, si bien son necesarios estudios más profundos para descartar completamente el origen natural de estas poblaciones. **Palabras clave:** *Lupinus bicolor*; corología; región Paleártica; sierra de Gredos; España.

INTRODUCTION

The genus *Lupinus* L. (*Fabaceae*) has approximately 280 accepted species mainly distributed throughout the American continent, with 13-14 species growing in Europe, the Mediterranean basin and North Africa (HUGHES & EASTWOOD, 2006; DRUMMOND, 2008; EASTWOOD & al., 2008; AÏNOUCHE & BAYER, 1999; CASTROVIEJO & PASCUAL, 1999; PASCUAL, 2004; WOLKO & al., 2011). To date, nine of these species grow in the Iberian Peninsula, of which eight are native and one introduced (CASTROVIEJO & PASCUAL, 1999; PASCUAL, 2004).

During the collecting trips carried out to prepare the checklist of the vascular plants of Sierra de Gredos, we have found some populations of a lupin species whose morphological features (fig. 1) differ from those species known for the Iberian species. After a detailed morphological study, we have concluded that these populations belong to *Lupinus bicolor* Lindl., an annual taxon native to Western North America, and whose presence in the Palearctic region had not been detected so far.

Here we provide chorological and ecological data on the populations of *Lupinus bicolor* found in Sierra de Gredos, as well as a discussion about its exotic or native status in the Palearctic region.

MATERIALS AND METHODS

Herbarium sheets from the MA herbarium and digital photos from the F herbarium have been used to compare our materials with the species from the American continent. These materials are:

Lupinus bicolor Lindl., California, Modoc County, 5 Km W of County Route 91 along the N side of the Pit River, Grassy S

facing slope, T41N R7E S35, 1340 m, 03-VI-1989, B. Bartholomew 4914 & B. Anderson (MA-524410). *Idem*, Kern County, ca. 5 miles south of Arvin, in cow pasture on open plain, associated with *Gilia tricolor*, *Plagiobothrys* and *Bromus*, C. Mankinen 1 (MA-262746). *Idem*, Nevada County, Pudingtone ridge 5 mi east of North Columbia on Graniteville Road, 4200 ft, 25-IV-1971, G.H. True & H.T. Howell (MA-558224).

Lupinus nanus Benth., California, Santa Barbara County, 300 yards east of northernmost end of Vandenberg Air Force Base, at summit of mountains on Point Sal, 16-IV-1968, Carl Mankinen (MA-190685). *Idem*, Monterey County, on Highway G16, 11.6 miles west of Greenfield, 20-III-1969, C. Mankinen 46 (MA-262779). *Idem*, Shasta County, 7.3 miles by road SW of McCloud Bridge, woods on *Pinus ponderosa*, *Quercus kelloggii*, *Q. chrysolepis*, *Arctostaphylos*, 1200 ft., G.L. Webster 7782, 16-IV-1993 (MA-538030).

Lupinus pachylobus Greene, California, 15-IV-1887, E.L. Greene, (F-0059418).

In the list of localities, we have abbreviated the collectors by their initials, which correspond as follows. **RSV:** Rogelio Sánchez-Villegas. **BQP:** Begoña Quirós de la Peña. **MSV:** Manuel Sánchez-Villegas. **ML:** Modesto Luceño. **IJC:** Ismael Jurado-Castillo. **AEG:** Arquímedes Escrig García.

RESULTS AND DISCUSSION

***Lupinus bicolor* Lindl.**

ÁVILA: 31TTK8376, 8377, 8478, 8771, 8374. Junciana, temporarily flooded spring meadows, 40°24'16.10"N 05°33'41.33"W, 999 m, 30-V-2018, RSV 282RSV21, IJC & ML. *Idem*, 40°24'55.56"N 05°33'20.57"W, 1019 m, 18-IV-2019 RSV & ML (UPOS-14173). El Losar del Barco, Becedillas river, temporarily flooded spring meadows, 40°25'21.72"N 05°32'5.59"W, 986 m, 19-IV-2019, RSV, ML & AEG (UPOS-14172). *Idem*, spring meadows, 40°23'31"N 05°32'29.96"W, 1025 m, 7-V-2019, MSV, ML & AEG (UPOS-14340). El Barco de Ávila, N-

110 road, Meadows near roadside edge, 40°21'36.82''N, 05°30'39.45''W, 1020 m, RSV, BQP & ML (UPOS-14339).

Most of the populations of *Lupinus bicolor* cited in this article (fig. 2) occur in temporarily flooded spring meadows in *Quercus pyrenaica* Willd. domain, with *Carex spicata* Huds., *Festuca rothmaleri*, (Litard.) Markgr.-Dannenb., *Saxifraga carpetana* Boiss. & Reut., *Armeria transmontana* (Samp.) G.H.M. Lawr., *Lupinus gredensis* Gand., *Reseda virgata* Boiss. & Reut., among other accompanying species. The individuals of these populations generally grow scattered throughout this habitat. The only population where the individuals grow densely is that from El Barco de Ávila, where the habitat is also a little different (meadows near roadside edges) and more typical for this species (SHOLARS, 2012).

Lupinus bicolor is a very variable species characterized by its annual habit, its petioled cotyledons and its small flowers with the keel generally ciliate on the upper margins near tip (SHOLARS, 2012). The Gredos populations are most similar to examined from Modoc County (MA-524410; fig 1). Further, it is interesting to point out that a preliminary molecular study using nuclear (*ITS*) and plastid (*trnT-L*) DNA regions of the populations of *L. bicolor* from Sierra de Gredos and several locations from the American continent (Sánchez-Villegas et al., in prep.) indicates that this species shows also an important molecular variability, so that the populations of Gredos differ from those sampled from North America which, in turn, also exhibit differences between them. Therefore, a more extensive North American sampling is needed to know if the Sierra de Gredos populations belong to an unsampled lineage introduced from the American continent or alternatively its presence in the Palearctic region is the result of a recent and natural migration from there.

Anyway, it is well known that lupines have traditionally been used as fodder plants for livestock (WOLKO, 2011), so it would not be unreasonable to think that the plants found in Sierra de Gredos may have been naturalised through this process. However, it is interesting to note that the populations from Gredos live in temporarily flooded spring meadows, along with native species, -although these meadows have a clear livestock use- which differs from the habitat described for this species in North America (open and disturbed areas; SHOLARS, 2012).

If it is confirmed that the plant is the product of a human introduction, and given the r-strategist character of the species (annual plants with good production of fertile

seeds) and the invasiveness of some of the species of this genus (eg., WASOWICZ, 2013; PRASS, 2021), it would be advisable to monitor the population dynamics of *L. bicolor*, as it could become a potential invasive species in the Iberian Peninsula.

In any case, our finding conforms a new chorological novelty for the European flora and the Palearctic region.

BIBLIOGRAFÍA

- AÏNOUCHE, A.K. & R.J. BAYER. (1999). Phylogenetic relationships in *Lupinus* (*Fabaceae: papilionoideae*) based on internal transcribed spacer sequences (ITS) of nuclear ribosomal DNA. *American journal of botany* 86(4): 590–607.
- CASTROVIEJO, S. & H. PASCUAL (1999). *Lupinus* L. in S. Talavera & al. (eds.), *Flora iberica* 7 (2): 251–260. Real Jardín Botánico. CSIC. Madrid.
- DRUMMOND, C.S. (2008). Diversification of *Lupinus* (*Leguminosae*) in the Western New World: Derived Evolution of Perennial Life History and Colonization of Montane Habitats. *Molecular Phylogenetics and Evolution* 48(2): 408–421.
- EASTWOOD, R.J., C.S. DRUMMOND, M.T. SCHIFFINOWITTMANN & C.E. HUGHES (2008). Diversity and Evolutionary History of *Lupinus* – Insights from New Phylogenies. *Proceedings of the 12th International Lupin Conference - Lupins for Health and Wealth*: 346–54.
- HUGHES, C., & R. EASTWOOD (2006). Island Radiation on a Continental Scale: Exceptional Rates of Plant Diversification after uplift of the Andes. *Proceedings of the National Academy of Sciences of the United States of America* 103(27): 10334–39.
- PASCUAL, H. (2004). *Lupinus mariae-josephi* (*Fabaceae*), nueva y sorprendente especie descubierta en España. *Anales Jard. Bot. Madrid* 61(1): 69–72.
- PRASS, M., S. RAMULA, M. JUANI, H. SETÄLÄ & D.J. KOTZE (2021). The invasive herb *Lupinus polyphyllus* can reduce plant species richness independently of local invasion age. *Biol. Invasions* (2021).
- SHOLARS, T. (2012). *Lupinus* in B.G. Baldwin, D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti & D. Wilken (eds.). *The Jepson manual: Vascular plants of California, 2nd ed.* University of California Press, Berkeley, California, USA.
- WASOWICZ, P., E.M. PRZEDPELSKA-WASOWICZ & H. KRISTINSSON (2013). Alien vascular plant in Iceland: Diversity, spatial patterns, temporal trends, and the impact of climate change. *Flora* 8: 648–673.
- WOLKO, B., J.C. CLEMENTS, B. NAGANOWSKA, M.N. NELSON & H. YANG (2011). *Lupinus* in C. Kole (ed.). *Wild Crop Relatives: Genomic and Breeding Resources, Legume Crops and Forages*.

(Recibido el 15-XI-2021)

(Aceptado el 5-XII-2021)

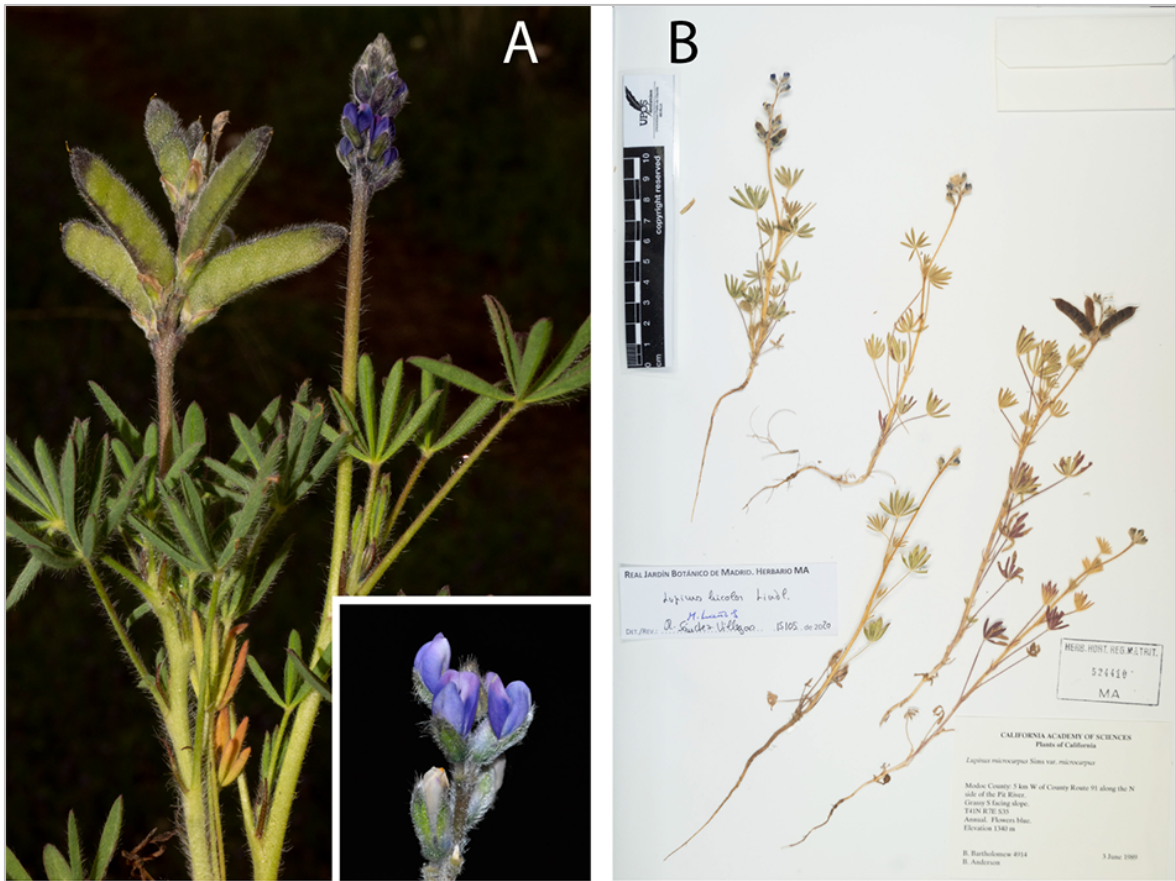


Figure 1. (A) *Lupinus bicolor* from western North America (MA-524410) and (B) from Sierra de Gredos.

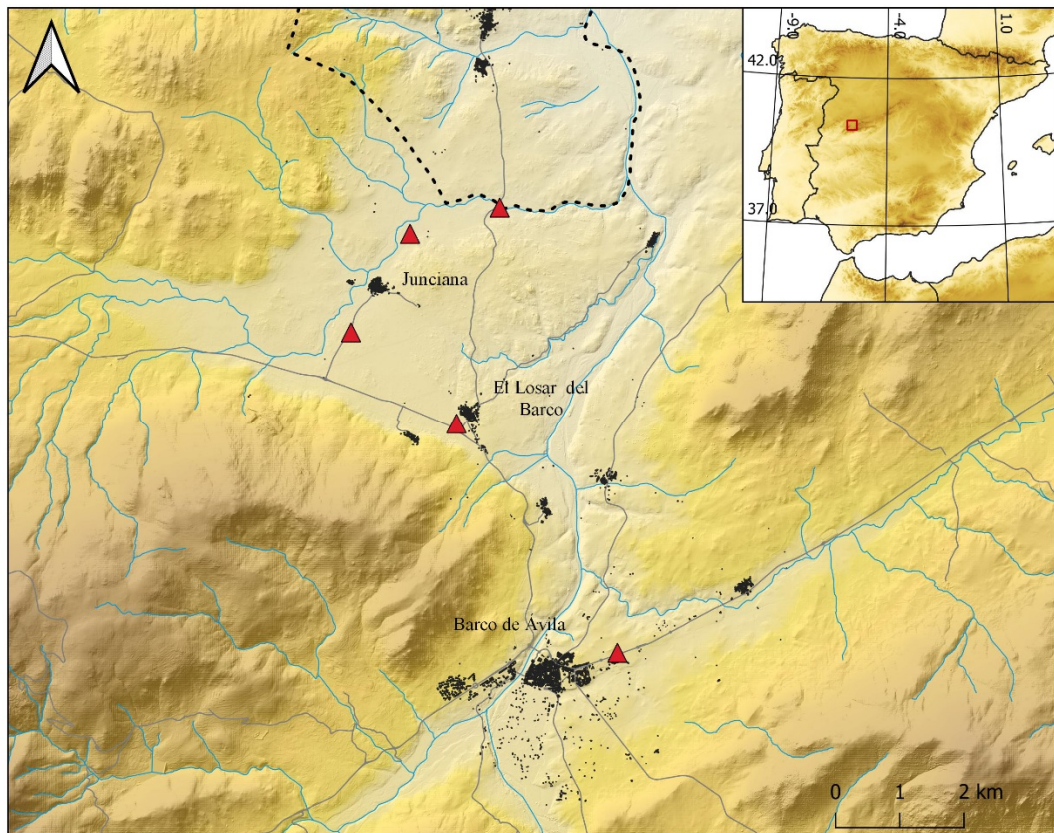


Figure 2. Distribution map of the known populations of *Lupinus bicolor* in the Iberian Peninsula. Red triangles represent the known populations of *L. bicolor*, black dashed lines represent provincial boundaries, grey lines represent roads and blue lines represent rivers. [Mapa de distribución de las poblaciones conocidas de *Lupinus bicolor* en la Península Ibérica (triángulos rojos), las líneas negras discontinuas representan los límites provinciales, las líneas grises las carreteras y las líneas azules los ríos].

NOVEDADES EDITORIALES

Flora Valentina, IV (Lamiaceae - Rhamnaceae)

Gonzalo Mateo Sanz, Manuel B. Crespo Villalba, Emilio Laguna Lumbreras

Ed. Jolube, 2021

Encuadernación tapa dura cosida, 22 x 27 cm, 362 páginas en **COLOR**

Fecha lanzamiento: **enero de 2022**

ISBN: 978-84-121656-9-2

PVP: 60€ + envío



Catálogo de la flora vascular del municipio de Zaragoza

Samuel Pyke

Monografías de Botánica Ibérica, nº 23

Encuadernación rústica fresada 17x 24 cm

180 páginas en B/N

Fecha lanzamiento: **diciembre de 2021**

ISBN: 978-84-124463-0-2

PVP: 12,50€ + envío

La cara amable de las malas hierbas, 3ª edición (2021)

Claves ilustradas para la determinación de los géneros y catálogo de especies

Alicia Cirujeda, Carlos Zaragoza, María León & Joaquín Aibar

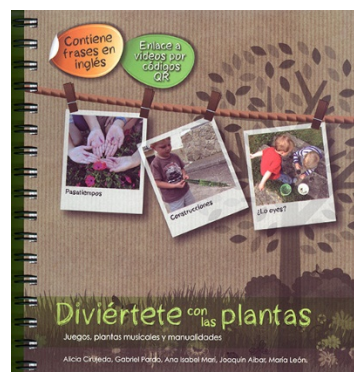
Encuadernación rústica 21 x 25 cm. 256 páginas en **color**

Edita: CITA-Gobierno de Aragón

Fecha lanzamiento: **diciembre de 2021**

ISBN: 978-84-87944-57-4

PVP: 20€ + envío



Diviértete con las plantas. Juegos, plantas musicales y manualidades

Alicia Cirujeda, Gabriel Pardo, Ana Isabel Marí, Joaquín Aibar & María León

Encuadernación anillas 20 x 22 cm, 256 páginas en **color**

Edita: CITA-Gobierno de Aragón

Fecha lanzamiento: 2016

ISBN: 978-84-8380-335-6

PVP: 28€ + envío

Orquídeas de Aragón 

Conchita MUÑOZ ORTEGA

Col. Guías imprescindibles de flora, nº 2

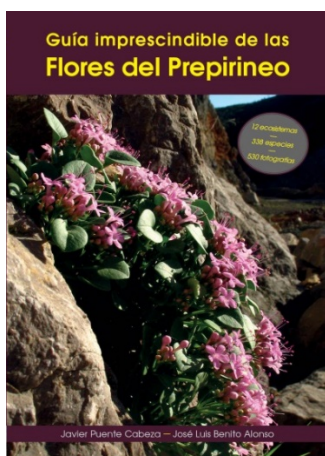
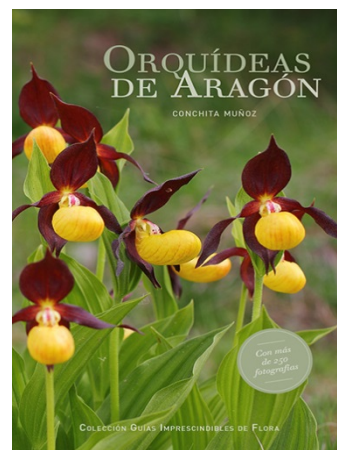
Encuadernación rústica 10 x 21 cm

202 páginas **en color con 250 fotografías**

Primera edición: abril de 2014

ISBN: 978-84-941996-1-5

PVP: 17,50 € + envío



Guía imprescindible de las flores del Prepirineo  

Javier PUENTE CABEZA & José Luis BENITO ALONSO

Col. Guías imprescindibles de flora, nº 3

Encuadernación rústica 17 x 24 cm

204 páginas **en color con más de 530 fotografías.**

Primera edición: abril de 2013

ISBN: 978-84-941996-4-6

PVP: 17,50 € + envío

Orquídeas de la provincia de Cuenca

Guía de campo  

Agustín Coronado Martínez y Eduardo Soto Pérez

Colección Guías imprescindibles de flora, 4

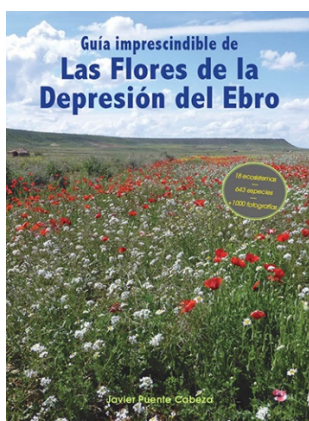
Encuadernación rústica 14,8 x 21 cm

252 páginas en **COLOR**

Fecha lanzamiento: mayo de 2017

ISBN: 978-84-945880-5-1

PVP: 25,95€ + envío



Guía imprescindible de las flores de la Depresión del Ebro  

Javier Puente Cabeza

Col. Guías imprescindibles de flora, nº 5

Encuadernación rústica 11 x 21,6 cm

380 páginas en **COLOR**

Fecha lanzamiento: **julio de 2018**

ISBN: 978-84-947985-3-5

PVP: 24,00€ + envío



Guía imprescindible de las flores del Parque Nacional de Ordesa y Monte Perdido, 2ª edición  

José Luis BENITO ALONSO

Col. Guías imprescindibles de flora, nº 1

Encuadernación rústica 17 × 23,5 cm

96 páginas color

Primera edición: mayo de 2009. **También edición en INGLÉS y FRANCÉS**

ISBN: 978-84-613-1776-9

PVP: 15,00 € + envío

Plantas de las cumbres del Pirineo. Flora del piso alpino 

Daniel Gómez, José Vicente Ferrández, Manuel Bernal, Antonio Campo, J. Ramón Retamero y Víctor Ezquerro

Ed. Prames. *Premio Félix de Azara, 2019*

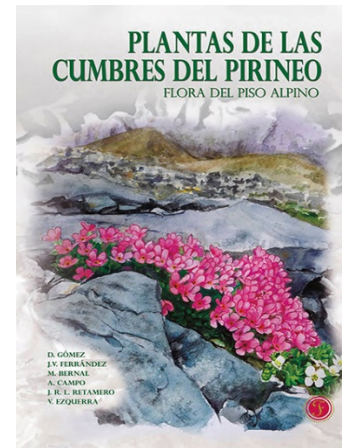
Encuadernación rústica cosida 18 x 24,5 cm

592 páginas en **COLOR**

Fecha lanzamiento: **agosto de 2020**

ISBN: 978-84-8321-920-1

PVP: 50€ + envío



Las plantas en la cultura tradicional de Ávila: Etnobotánica abulense  

Emilio BLANCO CASTRO

Monografías de Botánica Ibérica, nº 16

Encuadernación rústica 17 × 21,5 cm

344 páginas en **color**

Fecha lanzamiento: mayo de 2015

ISBN: 978-84-943561-0-0

PVP: 28€ + envío

Las gramíneas de la Península Ibérica e Islas Baleares  

Claves ilustradas para la determinación de los géneros y catálogo de especies

Carlos ROMERO ZARCO

Monografías de Botánica Ibérica, nº 15

Encuadernación rústica 17 × 24 cm

172 páginas en **color**

Fecha lanzamiento: abril de 2015

ISBN: 978-84-943561-1-7

PVP: 17,95€ + envío

