

A NEW HYBRID FROM SPAIN IN THE GENUS *PINUS* (*PINACEAE*)

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ABSTRACT: A natural hybrid in *Pinus*, *P. × saportae* nothosubsp. *currasii* is described from some localities in Valencian province (Spain), where both parents are found growing together. Morphological characters in this hybrid are intermediate between putative parental species: *P. halepensis* and *P. pinaster* subsp. *escarena*. We speculate that the hybrids examined are natural results of several generations of hybridization events. This hybrid may be more widespread but overlooked. Distinguishing features of all three taxa are thoroughly discussed and illustrated. **Keywords:** nothotaxon; Pine tree; taxonomy, Valencian Community; Spain

RESUMEN: Un nuevo híbrido para España en el género *Pinus* (*Pinaceae*). Un híbrido natural en *Pinus*, *P. × saportae* nothosubsp. *currasii* se describe de varias localidades de la provincial de Valencia (España), donde ambos progenitores se encuentran creciendo juntos. Los caracteres morfológicos de este híbrido son intermedios entre las especies parentales: *P. halepensis* y *P. pinaster* subsp. *escarena*. Especulamos que los híbridos examinados son resultados naturales de varias generaciones de eventos de hibridación. Este híbrido puede estar más extendido, pero ha pasado desapercibido. Las características distintivas de los tres taxones se discuten e ilustran. **Palabras clave:** nothotaxon; pino; taxonomía; Comunidad Valenciana; España.

INTRODUCTION

Pinus L. (*Pinaceae*) is the largest extant genus of conifers with over 100 recognized species (PRICE & al., 1998; FARJON, 2005, 2017; ECKENWALDER, 2009; DEBRECZY & RÁCZ, 2011). Putative hybrid species in *Pinaceae* are rarely documented (see e.g., *P. × densithunbergii* Uyeki, *P. × neilreichiana* Reichardt, *P. × hakkodensis* Makino, *P. × rhaetica* Brügger). However, hybridization in the genus may be more widespread but is often overlooked.

In some localities in Valencian province (E Spain) (e.g., Chera-Sot de Chera Natural Park, Plant Micro-Reserve “Pla de Mora” in Quatretonda, and Pico Nevera in Buñol) natural populations of plants with intermediate morphological characters between *P. halepensis* Mill. and *P. pinaster* subsp. *escarena* (Risso) K. Richt. have been found. In the all localities the hybrid individuals were detected among the parent species. This hybrid is described and illustrated in this work.

BACKGROUND

The hybridization of *P. pinaster* s.l. with *P. halepensis* was described by ROUY (1913), as *P. × saportae* [*P. × pinasteroides* Léveillé in Bull. Geogr. Bot., sér. 4, 25: 42. 1917, nom illeg.], but there are doubts about the identity of the maritime pine parental (see LÉVEILLÉ, 1917; <https://www2.dijon.inra.fr/flore-france/pi-pn.htm>).

The protologue of *P. × saportae* published by ROUY, 1913 (368) includes the names and references “*P. halepensi-pinaster* Saporta in *Comptes-rendus Acad. sc. Paris*, 1889, p. 656” (see SAPORTA, 1889: 656-657) and “*P. Pinaster × P. Halepensis* Asch et Gr., l. c., p. 232” (see ASCHERSON & GRAEBNER, 1896: 232), a brief diagnosis of the plant and the provenance “Hab. Vaucluse : trouvé, avec les parents, mais sans cones, à Mirabeau (G. [Gabriel] de Montigny) ; à rechercher” [Vaucluse, Provence-Alpes-Côte d’Azur, France]. However, no specimen or illustration were cited in this work. Furthermore, in Rouy collection at LY there are no specimens of *P. × saportae* (Melanie Thiebaut, pers. comm.).

Unfortunately, we have not found any original material for this name. Rouy himself indicates in the protologue “à rechercher”.

ASCHERSON & GRAEBNER (1896: 232) included a brief diagnosis for this hybrid, mentioned as “*P. pinaster × P. halepensis*”, and also included the name previously published by SAPORTA (1889) as “*P. halepensi-pinaster*” with the same provenance “in der Provence (Mirabeau, Dep. Vaucluse) von Gabriel de Montigny beobachtet”. Unfortunately, no specimen or illustration were cited in this work.

On the other hand, SAPORTA (1889: 656) mentioned that this hybrid was found by Gabriel de Montigny in Mirabeau (“Je dois la connaissance de cet hybride à M. Gabriel de Montigny, qui l’a découvert dans les dépendances de Mirabeau, repeuplées en Pins par son père, propriétaire de ce château historique. Il existe, dans le terroir de Mirabeau, au quartier de Puy-loubier, au milieu d’une contrée accidentée, boisée en *Pinus halepensis* Mill., une colonie de *Pinus Pinaster* L., formant un petit bois dont les pieds, distribués sur un hectare au moins, se montrent pressés vers le centre de la colonie, clairsemés vers ses limites extérieures, là où les deux espèces se trouvent entremêlées.”) [I owe the knowledge of this hybrid to Mr. Gabriel de Montigny, who discovered it in the Mirabeau outbuildings, repopulated with pine trees by his father, owner of this historic castle. There is, in the Mirabeau terroir, in the Puy-loubier district, in the middle of a mountainous terrain, wooded with *Pinus halepensis* Mill., a colony of *Pinus Pinaster* L., forming a small forest with their feet, distributed over at least one hectare, are shown concentrated towards the center of the colony, scattered towards its outer limits, where the two species intermingle], in the same provenance and with the same author cited in the protologue by ROUY (1913). SAPORTA (1889) included a diagnosis of this hybrid and mentioned that this plant is sterile and does not generate cones. Clearly, the protologue of ROUY (1913) was taken from SAPORTA (1889).

Gaston (Louis Charles Joseph) marquis de Saporta (1823-1895) was a French palaeobotanist living at St. Zacharie (Var, France). Some material of the Saporta collection are preserved at P and PC herbaria. However, we have not found any herbarium sheet of Saporta or Gabriel

de Montigny in any of the consulted herbaria (e.g., LY, MPU, P). In this sense, Rouy indicated in the protologue “à rechercher” [to search], and it is likely that Rouy never saw material of this hybrid, since his diagnosis is based on Saporta’s work.

BOISSIER (1842: 584) indicated that “in Gallia australi occidentali” [south France] the variety of *P. pinaster* is “*obtusisquama*” and this is in accordance with LÓPEZ GONZÁLEZ (2001), and therefore the parent of the hybrid is the subspecies type of *P. pinaster*. In this sense, SAPORTA (1889) mentioned that the variety (i.e., “*obtusisquama*”, included in *P. pinaster* subsp. *pinaster*) was introduced “...dans les dépendances de Mirabeau, repeuplées en Pins par son père, propriétaire de ce château historique.” [...in the outbuildings of Mirabeau, repopulated with pines by his father, owner of this historic castle...] and specifies that it is the northern limit of its distribution “La présence du *P. Pinaster* à Mirabeau, insolite en apparence, marque le point le plus avancé vers le nord qu’atteigne l’espèce dans cette direction, bien que cette présence soit en rapport avec celle de plusieurs autres colonies éparses dans la partie attenante du Var, notamment à Pontevès”.

Pinus halepensis Mill. (Aleppo pine or pino carrasco in Spanish) is the most widely distributed and abundant among the Mediterranean pines, extending from the western Mediterranean (Portugal, Spain, Morocco), where it is most abundant, to Lebanon through, in Europe, southern France, Italy, Greece and Turkey and, in Africa, Morocco, Algeria, Tunisia, and Libya (CRITCHFIELD & LITTLE, 1966; GAUSSEN & al., 1993; FARJON & FILER, 2013; FARJON, 2005, 2017; ECKENWALDER, 2009). *Pinus halepensis* forests are important for multi-purpose forestry and have a high ecological value. Aleppo pine has been used in several afforestation programmes, especially between the 1930s and 1970s, aiming at soil protection and wind breaks near the coast. On the other hand, it is also an important ornamental plant in gardens and parks in the Mediterranean region and in some arboreta around the world (NE’EMAN & TRABAUD, 2000; LÓPEZ GONZÁLEZ, 2001; RUIZ DE LA TORRE, 2006; SAN-MIGUEL-AYANZ & al., 2016).

Pinus pinaster Ait. (sect. *Pinus*, subsect. *Pinaster* Loudon) is a broadly distributed conifer in the western Mediterranean Basin, in Southern Europe (Italy, Spain, Portugal, France) and Africa (Morocco, Algeria, Tunisia), and the Atlantic coast in Portugal, Spain and France (GAUSSEN & al. 1964; PIGNATTI, 1982; do FRANCO, 1989; ALÍA *et al.*, 1996; ALÍA & MARTÍN, 2003; GERNANDT & al., 2005; TISON & FOUCAULT, 2014; TISON & al., 2014; ABAD VIÑAS & al., 2016). This distribution has been reshaped during the last two centuries by heavy afforestation, particularly in southwest France and in the Iberian Peninsula, and by invasive behaviour in disturbed areas (DEVY-VARETA, 1988; CARRION & al., 2000; BURBAN & PETIT, 2003). This species is cultivated worldwide in temperate regions and has been used in several afforestation programmes throughout the world (ALÍA & al., 1997; LE MAITRE, 1998). Because of the fragmentation of its natural range, the maritime pine exhibits a relatively high genetic differentiation among populations at nuclear markers in comparison to other conifer species (PETIT & al., 1995).

Pinus pinaster is sometimes split into two or three subspecies: subsp. *pinaster* (= “*atlantica* Villar”) (distributed in the Atlantic coasts of SW Europe) [*P. pinaster* subsp. *atlantica* Villar, Bol. Soc. Esp. Hist. Nat. 33: 427. 1934, nom. inval. (*ICN*

Art. 38.1)], subsp. *escarena* (Risso) K. Richt. (*P. escarena* Risso) [= *P. escarena* Risso, Hist. Nat. Prod. Eur. Mérid. 2: 340. 1826 ≡ *P. pinaster* var. *escarena* (Risso) Loudon, Arbor. Frutic. Brit. 4: 2214. 1838] (distributed in the Mediterranean coasts of SW Europe), and subsp. *renouri* (Villar) Maire (*P. pinaster* var. *renouri* Villar) [incl. var. *maghrebiana* Villar] (distributed in North Africa) (see GAUSSEN & al., 1964; RUIZ DE LA TORRE, 2006; FARJON, 2017; EARLE, 2019).

In this paper the new hybrid between *P. halepensis* and *P. pinaster* subsp. *escarena*, is formally described. Features distinguishing it from both parent species are provided and illustrated.

MATERIAL AND METHODS

Specimens of *P. halepensis*, *P. pinaster* subsp. *escarena* and their putative hybrid were collected in Chera-Sot de Chera Natural Park (Chera), between 2016 and 2022. Voucher specimens of all taxa are deposited in the herbarium of the Botanic Garden of University of Valencia, Spain (VAL).

RESULTS AND DISCUSSION

Pinus × *saportae* nothosubsp. *currasii* P.P. Ferrer, E. Laguna, R. Roselló & J.B. Peris, **nothosubsp. nov.** (figures 1 and 2)

[= *P. halepensis* Mill. × *P. pinaster* subsp. *escarena* (Risso) K. Richt.]

Diagnosis: Differ from *Pinus halepensis* by their larger size, stiffer, broader and longer leaves, and larger female cones. Differ from *P. pinaster* subsp. *escarena* by its lower height, less rigid and shorter leaves, and smaller female cones.

HOLOTYPE: Spain, Natural Park of Chera-Sot de Chera, Chera, camino de Cinco Pinos-Pico Tío Gaspar, several specimens between the parent species *P. halepensis* and *P. pinaster* subsp. *escarena*, 671374 / 4384776, 22-VII-2022, *P. Pablo Ferrer-Gallego s.n.*, VAL 252111. **Isotype:** BC, MA, VAL 252112.

Description: Tree to 20-30 m tall; trunk to 0.8-1.2 m d.b.h., straight or curved; bark on trunks separated by broad and deep, blackish fissures; branches long, spreading and ascending; dense and rounded crown; foliage branches stout; terminal bud 10-20(25) mm long, 6-10 mm wide, oblong-conical, not resinous; cataphylls red-brown, reflexed; leaves in fascicles of 2, held by a persistent, 3-6 mm long, dark grey basal sheath, remaining on branchlets 2-3 years, straight or sometimes slightly curved, rigid, 6.5-9(10) cm long, not or slightly twisted, 0.9-1 mm wide, lustrous grey-green or dark green; margins minutely serrulate; apex acute or pungent; stomata in conspicuous lines on all faces; pollen cones cylindrical, 1.5-3.5 cm long, yellow; seed cones solitary or more often in whorls of 2-3, short pedunculate, persistent several years, spreading or reflexed, narrowly ovoid-conical when closed, 8-11 cm long and 6.5 cm wide when closed, open before falling; seed scales thick woody, rigid, small and imbricate near the slightly oblique cone base, much larger and longer beyond, spreading wide, oblong, more or less flat; seed scales thick woody, rigid, small and imbricate near the slightly oblique cone base, much larger and longer beyond, spreading wide, oblong, more or less flat; apophyses

broadly rhombic in outline, raised and thickened to pyramidal; umbo dorsal, central, forming a straight or forward curved, short spine; seed obovoid-oblong, 6-7 mm long, grey or blackish grey, wing 16-19 mm long, 7-9 mm wide (see figures 1 and 2, and table 1).

Etymology: The epithet of the name of the new nothospecies recalls the surname of the illustrious deceased Dr. Forest Engineer and Botanist Rafael Currás Cayón (1940-2020), professor of Botany and Ecology at the University of Valencia (Spain) and Director of CIEF (Centre for Forestry Research and Experimentation) at Generalitat Valenciana.

Distribution and ecology: Sclerophyllous species, well represented in a concrete area of the Natural Park of Chera-Sot de Chera where it occupies the humid, north slopes. The distribution area covers the mesomediterranean bioclimatic belt characterized by forests of *Quercus ilex* subsp. *rotundifolia* and occupies the potential space of the associations of the order *Quercetalia ilicis* Br.-Bl. ex Molinier 1934 (sclerophyllous oak forests in the western part of the Mediterranean basin). The presence of *Quercus ilex* subsp. *rotundifolia* to which they are associated include also: *Quercus coccifera* L., *Quercus faginea* Lam., *Acer granatense* Boiss., *Pinus halepensis* Mill., *Crataegus monogyna* L., *Daphne gnidium* L., *Rosa agrestis* Savi, *Rhamnus infectoria* L., *Salvia rosmarinus* Schleid., *Arcostaphylos uva-ursi* (L.) Spreng., *Santolina ericoides* Poir., among herbaceous species: *Helichrysum italicum* (Roth) G. Don, *Centaurea gabrielis-blancae* Fern. Casas, *Brachypodium retusum* (Pers.) P. Beauv., *B. phoenicoides* (L.) Roem. & Schult., *Saponaria ocyroides* L. It has been also found in the Nevera peak (municipality of Buñol), on a similar habitat but at the sunny face of that mountain, which reaches the highest altitude of Malacara Mts. -1,118 m-, at central area of the province of Valencia. A third site, the Plant Micro-reserve "Pla de Mora" (municipality of Quatretondeta), at the Southern part of the same province, fits best the thermomediterranean belt, and the plant community is dominated by thermophilous species such as *Pistacia lentiscus* L. and *Chamaerops humilis* L.

Characters of the population: The population of the species occurs in an area of about 2 hectares inside the Natural Park of Chera-Sot de Chera. Within this area, it is estimated the number of mature individuals exceeds hundred units. The hybrids occurs in a extensive group of plants of various ages and development. Both in Buñol and Quatretondeta, it deals with one isolated individual per population.

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Figure 1. Female cones and leaves of *Pinus pinaster* subsp. *escarena* (1 & 2), *P. × saportae* nothosubsp. *currasii* (3, from the holotype specimen at VAL 252111), and *P. halepensis* (4).

Table 1. Diagnostic features among *Pinus halepensis*, *P. pinaster* subsp. *escarena* and *P. × saportae* nothosubsp. *currasii*. Data for *P. halepensis* and *P. pinaster* subsp. *escarena* based on own observations as well as modified from do FRANCO (1989), ALÍA *et al.* (1996), RUIZ DE LA TORRE (2006) and FARJON (2005, 2017); data for *P. × saportae* nothosubsp. *currasii* based on own observations.

	<i>P. halepensis</i>	<i>P. × saportae</i> nothosubsp. <i>currasii</i>	<i>P. pinaster</i> subsp. <i>escarena</i>
Habit and size	tree to 20 m tall	tree to 20-30 m tall	tree to 25-40 m tall
Trunk	to 80 cm d.b.h. straight, curved or sinuous, often forked, grey-brown, becoming thick only on lower trunk of large trees, then fissured longitudinally, scaly, breaking into elongated plates, purplish brown to red-brown, weathering grey	to 0.8-1.2 m d.b.h. straight or curved; bark on trunks of larger trees breaking into large, irregular, more or less smooth plates separated by broad and deep, purplish brown to red-brown, weathering grey, blackish fissures	to 1.5 m d.b.h. straight or curved; bark on trunks of larger trees breaking into large, irregular, more or less smooth plates separated by broad and deep, blackish fissures
Branches	branches numerous, spreading and ascending, forming a broadly rounded, sometimes flat-topped, dense crown, foliage branches slender	branches long, spreading and ascending; higher order branches in lower crown drooping, forming a dense, rounded crown, foliage branches stout	branches long, spreading and ascending; higher order branches in lower crown drooping, forming a dense, rounded crown, foliage branches stout
Terminal bud	5-10 mm long, ovoid-conical, acute, not resinous	10-20(25) mm long, 6-10 mm wide, acute, not resinous	20-35 mm long, 8-12 mm wide, oblong-conical, not resinous
Cataphylls	reddish brown fringed with hairs	reddish brown	red-brown, reflexed
Leaves	in fascicle of 2, held by a 9-12 mm long, persistent sheath, falling in the third year, straight and rigid, spreading, (6)7-10(12) cm long, 0.7-0.8 mm wide; margins minutely serrulate; leaf color light green	in fascicles of 2, held by a persistent, 3-6 mm long, dark grey basal sheath, remaining on branchlets 2-3 years, straight or sometimes slightly curved, rigid, 6.5-9(10) cm long, not or slightly twisted, 0.9-1 mm wide, lustrous grey-green or dark green; margins minutely serrulate; apex acute or pungent	in fascicles of 2, held by a persistent, 20-30 mm long, dark grey basal sheath, remaining on branchlets 2-3 years, straight or sometimes slightly curved, rigid, 10-20(25) cm long, not or slightly twisted, 1.5-2 mm wide, lustrous grey-green or dark green; margins denticulate; apex acute or pungent
Leaf stomata	stomata in fine line on all surfaces	stomata in conspicuous lines on all faces	stomata in conspicuous lines on all faces
Pollen cones	cylindrical, 1-2 cm long, yellow	cylindrical, 1.5-3.5 cm long, yellow	cylindrical, 2-4 cm long, yellow
Seed cones	solitary or in whorls of 2-3, short pedunculate, directed backward or more or less spreading when full grown, long persistent, narrowly or broadly ovoid-conical when closed, sometimes slightly asymmetrical, 6-10(12) cm long, variously serotinous, 3-5 cm wide when close, 4-7 cm wide when opened; seed scales thick woody, rigid, straight, oblong	solitary or more often in whorls of 2-3, short pedunculate, persistent several years, spreading or reflexed, narrowly ovoid-conical when closed, 8-11 cm long and 6.5 cm wide when closed, open before falling; seed scales thick woody, rigid, small and imbricate near the slightly oblique cone base, much larger and longer beyond, spreading wide, oblong, more or less flat	solitary or more often in whorls of 2-4, short pedunculate, persistent several years, spreading or reflexed, narrowly ovoid-conical when closed, 10-22 cm long and 5-8 cm wide when closed, not opening soon but usually open before falling; seed scales thick woody, rigid, small and imbricate near the slightly oblique cone base, much larger and longer beyond, spreading wide, oblong, more or less flat
Apophyses	apophyses nearly flat or slightly raised, weakly transversely keeled and with thin rays radiating from the centre, more or less rhombic or often with a rounded upper margin, to 20 mm wide at mid-cone, lustrous orange-brown or red-brown weathering grey	apophyses broadly rhombic in outline, raised and thickened to pyramidal	broadly rhombic in outline, raised and thickened to pyramidal, prominently transversely keeled and mostly also with 2-3 raised longitudinal ridges, lustrous orange-brown or red-brown
Umbo	flat or depressed, 4-7 mm wide, broadly rhombic in outline, tan or grey-brown, unarmed	umbo dorsal, central, forming a straight or forward curved, short spine	dorsal, central, forming a straight or forward curved, short spine;
Seed	obovoid, slightly flattened, (5)6-7(8) mm long, grey-brown, dark mottled; wing 15-25 mm long, 8-12 mm wide	obovoid-oblong, 6-7 mm long, grey or blackish grey, wing 16-19 mm long, 7-9 mm wide	obovoid-oblong, (7)8-10(12) mm long, grey or blackish grey, wing 22-30 mm long, 7-10 mm wide,

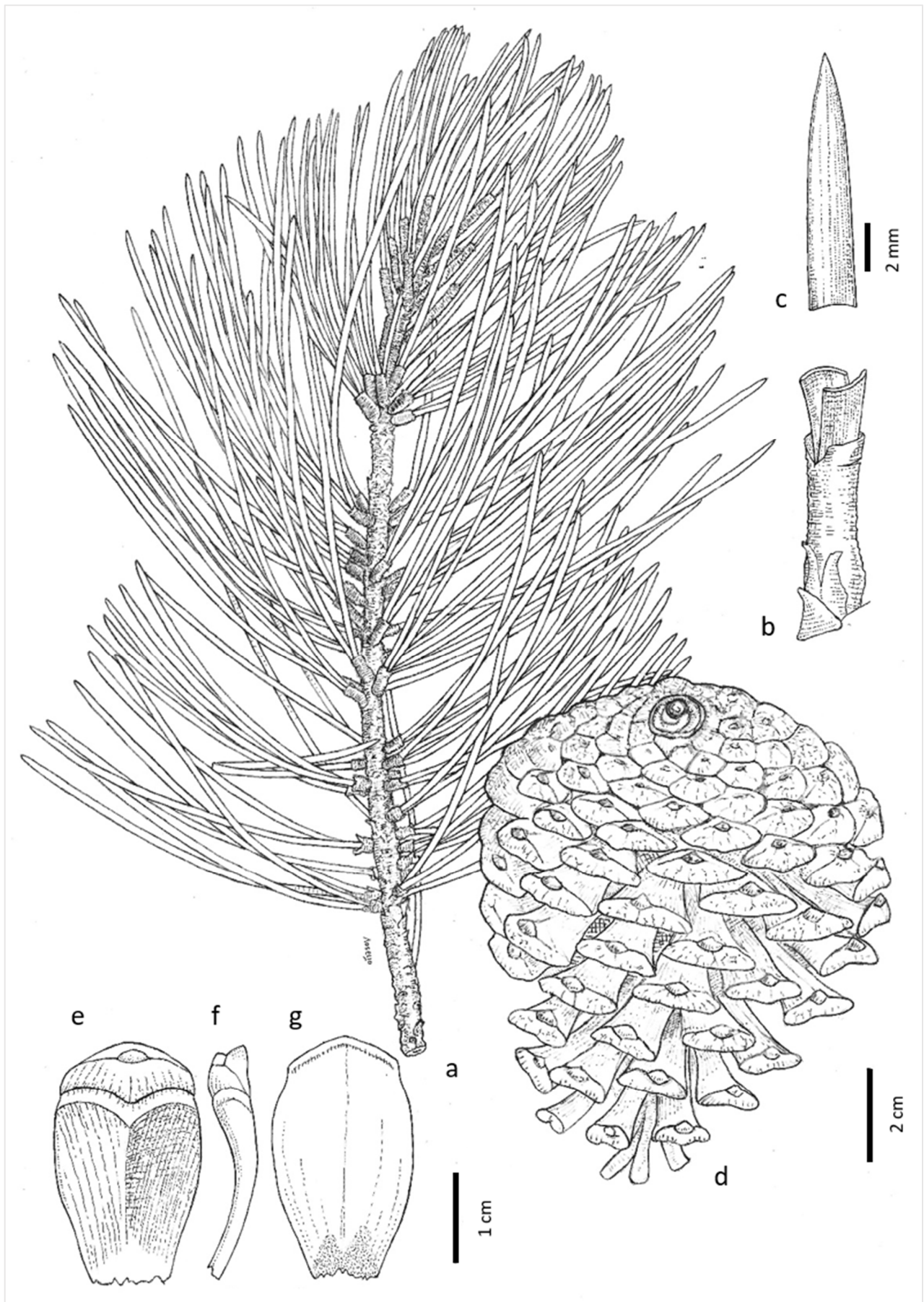


Figure 2. *Pinus* × *saportae* nothosubsp. *currasii*, a) habit; b) leaves in fascicle of 2, basal part of the leaf; c) apical part of the leaf; d) seed cone; e) scales, abaxial surface; f) scales, lateral surface; g) scales, adaxial surface. Voucher: Spain, Natural Park of Chera-Sot de Chera, Chera, camino de Cinco Pinos-Pico Tío Gaspar, *P. Pablo Ferrer-Gallego s.n.* (from the holotype specimen at VAL 252111). Illustration by Roberto Roselló.

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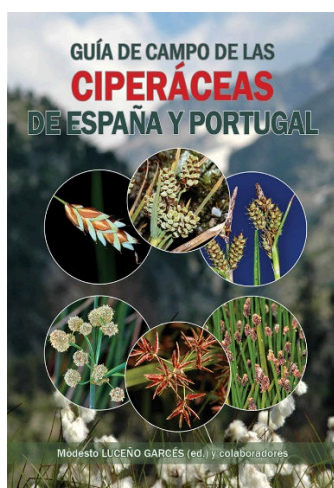
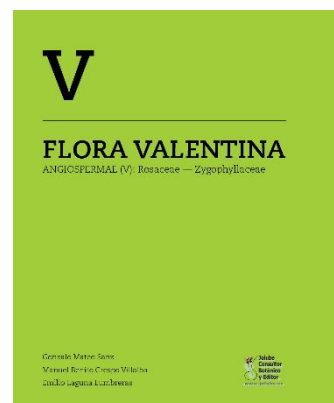
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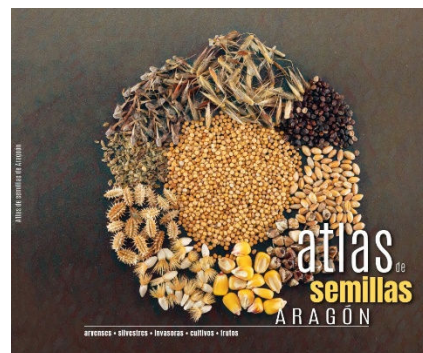
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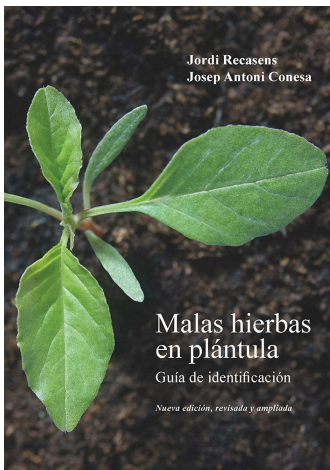
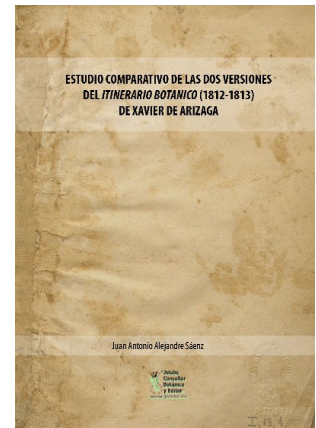
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