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Typification and characterization of *Orobanche ritro* Gren. & Godr. (*Orobanchaceae*) of central and southern Europe

Typification et caractérisation d'*Orobanche ritro* Gren. & Godr. (*Orobanchaceae*) d'Europe centrale et du Sud

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Abstract: *Orobanche ritro*, which is frequently considered a synonym of *O. elatior*, is lectotypified here from Grenier's original material in the herbarium of the Muséum National d'Histoire Naturelle, Paris (P). A morphological description focusing on the particular characters which distinguish it from related species is provided. The conspecificity of *O. echinopis* with *O. ritro* is pointed out. *O. ritro* occurs in central and southern areas of Europe, from north-east Spain to south-west European Russia and warrants recognition at species level.

Keywords: broomrape; Flora Europaea; nomenclature; Orobanche echinopis; typification

Résumé: *Orobanche ritro*, souvent considéré comme un synonyme d'*O. elatior*, est lectotypifié ici à partir du matériel original de l'herbier du Muséum national d'histoire naturelle, Paris (P). Nous fournissons sa description morphologique mettant l'accent sur les caractères particuliers qui le distinguent des autres espèces proches. La conspécificité d'*O. echinopis* avec *O. ritro* est démontrée. *O. ritro* habite dans les zones centrales et méridionales de l'Europe, du nord-est de l'Espagne au sud-ouest de la Russie européenne, et mérite d'être reconnu comme espèce.

Mots clé: Orobanche; Flora Europaea; nomenclature; Orobanche echinopis; typification

Introduction

Orobanche ritro was first described by Grenier and Godron in *Flore de France* 2: 635 (1853) on material collected by Grenier in Gap and by Boullu in Guillestre (France), parasitizing on roots of *Echinops ritro* L. (Asteraceae). Reichenbach (1862: 97) confirmed its presence in France and Loscos (1878–1880: 125) deemed it a non-rare species in Castelserás (Teruel, Spain). Also, Saint-Lager (1883: 610) initially reported it as *O. rhytrosepiphyta* in southern France and subsequently (Saint-Lager, 1889: 649) designated it as *O echinopophya*, both names being superfluous.

Pančić (1868: 80) reported its presence in Romania by referring to the same host ("…*in radice Echinopis Ritronis (?)*"[sic.]) in describing *O. echinopis* Panc. Nyman (1881: 560) deemed *O. ritro* dubious (?) in southern France and recognized *O. echinopis*, albeit as a subspecies subordinated to *O. salviae* F.W. Schultz.

For no apparent reason, Beck (1890: 171) considered it a form subordinate to *O. major* L., a taxonomic rank he maintained (Beck, 1930: 251) in reporting its presence in France (Dép. Hautes Alpes, Gap, le Devès bei Rabou, Guillestre) and Italy [Im Ceviere Tale der Cottichen Alpen (Rostan)]. However, Beck (1893: 1083; 1930: 250) referred to *O. echinopis* as a mere synonym for *O. major.*

Willkomm (1893: 189) used the previous reference by Loscos to grant this taxon the status of variety [*O. major* β *ritro* (Gren. & Godr.) Willk.]. Lázaro-Ibiza (1896: 810) also dealt with it as a variety. Rouy (1909: 181) initially considered it a mere race and subsequently (Rouy, 1927: 204) a subspecies. Douin (1926: 97) also deemed it a subspecies, subordinate to *O. major.*

However, some prominent botanists have refused to consider *O. ritro* an autonomous taxon and dealt with it as a synonym for *O. major* (Jackson, 1895: 374; Fiori, 1902: 480; Coste, 1937: 70; Borza, 1949: 253, sub *O. echinopis*; Fournier, 1977: 199) or *O. elatior* Sutton (Chater & Webb, 1972: 359; Pignatti, 1982: 614; Greuter *et al*., 1989: 260; Zázvorka, 1997: 513–514; Foley, 2001: 71; Domina & Raab-Straube, 2009). Also, other authors have included the genus *Echinops* L. among the hosts for *O. major* (Novopokrosky & Tzvelev, 1958: 132; Mądalski, 1967: 51) or *O. elatior*

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(Gilli, 1974: 496; Tzvelev, 1981: 334; Uhlich *et al*., 1995: 135) without referring to *O. ritro*, not even as a synonym.

Recently, Carlón *et al*. (2003: 31) reinstated its varietal rank and Pujadas-Salvà (2005) its species rank.

Finally, Zázvorka (2010: 82) includes it as a synonym for *O. kochii* FW. Schultz, without ever having studied any original material from Grenier. The images of the lectotypes of *O. kochii* and of *O. echinopis* (= *O. ritro*) chosen by Zázvorka (2010: 102, Fig. 12; 103, Fig. 13) have a dissimilar appearance and confirm that these two taxa are different rather than conspecific. To the naked eye, *O. kochii* has a lax inflorescence and *O. echinopis* a dense inflorescence. In addition, closer inspection of *O. ritro* reveals other important morphological differences from *O. kochii* regarding calyx shape, corolla shape and color, and number of flowers on the inflorescence, among others. Moreover, neither Schultz (1847), nor Maly (1842, 1851, 1857) cited *Echinops* as a possible host of *O. kochii*.

This paper revises the taxonomic status of *O. ritro* and examines its morphology in contrast with *O. salviae* and with *O. elatior* (= *O. major* L., p.p. [nom. rejic.]), to which it has previously been subordinated, and also with *O. icterica* Pau, with which it can co-exist and may also be confused. *O. ritro* is here lectotypified; its distribution, habitat and phenology are provided.

Material and methods

Orobanche ritro specimens from the COI, JACA, MA, P, PRC, W and WU herbaria, and the private herbarium of J.V. Ferrández (JVF), were studied (see Appendix 1). These specimens were also examined in search for original material from Grenier and Godron.

Pančić's, *O. echinopis* type material from the BEOU and PAD herbaria, was also examined in order to confirm whether this taxon is in fact conspecific with *O. ritro*.

Reported data from Koch (1833: 458-459), Reichenbach (1862: 96; t. 179, MDCCC), Beck (1930: 267), Gilli (1974: 501-502) and Chater & Webb (1972: 293) were used to distinguish and separate *O. ritro* from *O. salviae*.

The *O. ritro* specimens were compared with *O. elatior* and *O. icterica* material from the ABH, BC, COA, JACA, K, MA, MUB, VAB, VAL herbaria (cf. Pujadas-Salvà *et al*., 2005). Reported data from Grenier & Godron (1853) and Pančić (1868) were also used in the analysis.

Results

Lectotypification

Orobanche ritro is lectotypified here on the basis of material reported as collected in the places named in the protologue, namely: "collines sèches des environ de Gap, en allant à Rabou et à la Grangette (Gren.); Guillestre (Boullu)". Only two sheets with material from such places could be found in the P and W herbaria, namely: "Gap, 1857, *Grenier*, W" and "Rabou près Gap, sur l'*Echinops ritro*, 14-VIII-1848, *Grenier*, P". Both sheets contained material collected by Grenier in Gap (a place in southern France named in the protologue), but only the latter material was collected before the description of the species in 1853.

Material conserved as a «topo» type in the P herbarium [*viz*. Orobanche ritro Gren. / Rabou Lagarde juillet / style garni de quelques poils glanduleux / au dehors du stigmate qui est jaune / Blanc 1854] is not used for lectotypification here, however, as this locality was not mentioned in the protologue.

Because no additional testimonies of the material studied by Grenier could be found, we chose to use the sheet voucher kept as type material in the P herbarium and selected as lectotype here.

Orobanche ritro Gren. & Godr., Fl. France 2: 635. 1853 ≡ *Orobanche rhytrosepiphyta* St. Lager, Cat. Flore du Bassin du Rhône: 610. 1883 [nom. illeg.] ≡ *Orobanche echinopophya* St. Lager, in Cariot, Étude des fleurs, éd. 8, II: 649. 1889 [nom. illeg.] ≡ *Orobanche major* f. *ritro* (Gren. & Godr.) Beck, Biblioth. Bot. 19: 171. 1890 ≡ *Orobanche major* var. *ritro* (Gren. & Godr.) Willk., Suppl. Prodr. Fl. Hispan.: 188. 1893 ≡ *Orobanche major* race *ritro* (Gren. & Godr.) Rouy, Fl. France 11: 181. 1909 ≡ *Orobanche major* subsp. *ritro* (Gren. & Godr.) Douin, Fl. Compl. France, Suisse & Belg. 8: 97. 1926 – Ind. loc.: «*Hab*. Sur les racines de l'*Echinops ritro*; collines sèches des environs de Gap, en allant à Rabou et à la Grangette (*Gren*.); Guillestre? (*Boullu*) Juillet.»

-Lectotype (designated here): Orobanche ritro - nob. / couleur jaune pâle. / Rabou près Gap. Sur l'Echinops ritro / 14 août 1848 / Grenier / (handwritten by Grenier)

In addition, the sheet contains the following handwritten label by Reuter:

Belle espèce que je ne connais pas! / probablement nouvelle. / (Reuter) 1851 / (P!)

= *Orobanche echinopis* Pančić in Österr. Bot. Zeit.: 80 (1868) ["Habitat copiosissima in arena mobili ad Vakarec et Fontina fetje agris Romanorum in Banatu parasitica in radice Echinopis Ritronis (?). Floret Julio"]

= *Orobanche salviae* subsp. *echinopis* (Pančić) Nyman, Consp. Fl. Eur.: 560 (1881)

Orobanche major auct. p.p. (eg. Fiori, Fl. Italia 2: 480. 1902; Coste, Fl. Descr. France 3: 70. 1937) non L.

Orobanche elatior auct. p.p. (eg. Chater & Webb, Fl. Eur. 3: 359.1972; Greuter *et al*., Med-Checklist 4: 260. 1989) non Sutton

Orobanche kochii auct. p.p. (eg. Zázvorka, *Acta Mus. Morav., Sci. Biol*. 95(2), 77-119. 2010) non F.W. Schultz

Iconography. Fig. 1 (Photography); Reichenbach (1862: t. 170, MDCCXCI); Pujadas-Salvà (2005) (Photography).

Fig. 1. *Orobanche ritro*. France, Rabou près Gap, sur l'*Echinops ritro*, 14 VIII 1848, Grenier (P). Lectotype.

Morphological description

The description of *Orobanche ritro* (Grenier and Godron 1853: 635) is quite comprehensive and includes several distinct features such as its having bracts smaller than its corolla; ovate, bifid, several-nerved sepals; tubular, slightly pubescent to glandular, sulphur-yellow coloured corolla with a near-straight back; villous filaments in the lower half and sparse glandular hairs in the apex. However, studying the material examined here allowed us to discover various additional morphological features which may further facilitate its identification:

Plant 20–56 cm. Stem 4–10 mm in diameter at half height, robust, scarcely swollen at base [8–10(15) mm in diameter], shortly glandular hairy with rusty glandular short hairs 0.1–0.5(0.6) mm in size, creamy yellow stem (cream-like with a red ting when dry). Basal leaves 8–12 (15) × 5–8 mm, triangular to deltoid in shape, sub-imbricate to sparse; upper leaves 12–20(25) × 3.5–6(9) mm, widely lanceolate to ovate, erect–patent to patent, rusty glandular hairy, with short hairs (0.2–0.3 mm, up to 0.7 mm at base). Inflorescence 7–22 × 2.9–3.5 cm, cylindrical, rounded, occasionally sub-comose apex, dense, with many flowers. Bracts (12)13–20(24) × (3.5)4–6.5 mm, smaller than the flowers, but equalling the corolla lower lip, widely lanceolate, deflected, with rusty glandular hairs 0.1–0.6 mm, the longest lying near bract bases. Calyx segments, 10–16(19) × (3.5)4–5.5 mm, several-nerved with prominent veins, segments ± ovate, broad-based, free, separated or contiguous, rarely connate abaxially (some inflorescences contain both free and connate calyx segments), two short teeth, unequal to subequal, shortly bipartite to bifid, occasionally emarginate, teeth smaller or as long as one-half the segment length [1/2–1/3(1/5) segment length], triangular teeth with 2–3 veins running lengthwise, calyx scarcely hairy to glabrescent at base, with glandular hairs up to 0.2 mm, hairy teeth, with glandular hairs *c*. 0.2 mm long and up to 0.6 mm at the margin, creamy coloured calyx, occasionally red-tinged. Corolla 17–23 mm, erect to erect–patent, rarely patent, tubular, generally straight, straight or occasionally slightly curved back, glabrescent at the lower half, with short glandular hairs (< 0.2 mm), hairy in the upper half with glandular hairs 0.1–0.3 mm, more abundant especially on the back, colour pale yellow, sulphur-yellow or creamy, limb veins rarely tinged reddish-brown (straw-coloured corolla with red-tinged limb when dry). Corolla margin erose, glabrous or glabrescent, with scant, sparse hairs *c*. 0.1 mm long; widely bilobate, scarcely emarginated upper lip with porrect, occasionally patent lobes, and deflected, trilobate lower lip with subequal lobes, the central lobe slightly larger than the lateral ones, widely obovate. Obliquely inserted filaments, adaxial filaments inserted (3)4.5–6 mm above corolla base, abaxial filaments inserted at (1.5)2–4 mm, slightly geniculate, densely villous in the basal ½– ¾, with long hairs 0.3–0.7 mm, and glandular hairs, *c*. 0.1 mm in size, below anthers, occasionally sub-glabrous. Anthers 1.5–1.9 mm (apiculum 0.2–0.4 mm), oblong, papillate hairs on suture, yellowish or creamy coloured. Ovary glabrescent with scant hairs (< 0.2 mm) spread at apex, occasionally glabrous. Style with glandular hairs (< 0.3 mm), more abundant below stigma, occasionally sub-glabrous. Stigma bilobate, included, bright yellow.

Habitat, distribution and phenology

Orobanche ritro grows in open spaces of xerophytic bush areas and also, occasionally, in degraded scrubland, meadows, dry pasture, sub-ruderalized zones under a generally dry, sunny climate, occasionally on sandy or gypsiferous soils. The taxon is known to parasitize roots of *Echinops ritro* (Asteraceae), and has also been encountered on *E. sphaerocephalus* L. (cf. Saint-Lager 1889: 650). In addition, Beck (1890: 36) named *E. bovei* Boiss. (apud Debeaux) and *E. ruthenicus* M. Bieb. (apud Borbás) as hosts of *O. major* L, when in fact they are highly likely to be *O. ritro* hosts. This species occurs at heights from 300 to 1300 m and flowers from May to August. It can be found in areas of central and southern Europe from the north-east of the Iberian Peninsula (Spain) to the south-west of Russia, in the Volgograd Region (European Russia).

Relationship to other species

Orobanche ritro exhibits a number of morphological characteristics not present jointly in any other taxon known to date.

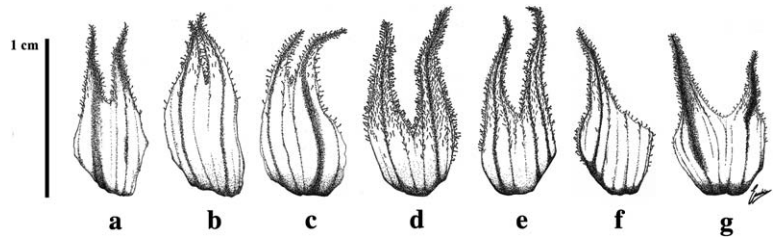

Fig. 2. Calyx segments. *Orobanche ritro*: a) France, Rabou (P) (lectotype), b) Spain, Huesca, Ortilla, (JACA 344296); c) Romania, Ad vallum Romanorum legionum Serbio-banaticae, (WU 771). *O. elatior*: d) England, Hants, Bury Hill, Andover (K); e) Hungary, National Park of Hortobágy (COA 16491); *O. icterica*: f) Spain, Alicante, Cap de les Hortes (COA 25532); g) Spain, Almería, Vélez Blanco (COA 37658).

Table 1. Main differences between *O. ritro* Gren. & Godr., *O. elatior* Sutton and *O. icterica* Pau.

Character	*O. ritro*	*O. elatior*	*O. icterica*
Stem base diameter (mm) / thickness	8–10 Slightly swollen	(7)11–30 Slightly swollen to bulb-shaped	9–14 Slightly swollen to clavate
Basal leaves	Sub-imbricate to sparse	Densely imbricate	Densely imbricate
Upper leaves, width (mm)	3.5–6(9)	(2)3–5(6)	4.5–8.5
Upper leaves, shape	Widely lanceolate to ovate	Lanceolate, narrow	Ovate to narrowly ovate
Calyx height (mm)	10–16(19)	9–15	(7)8–11(15)
Calyx segments, position	Free, separated or contiguous, rarely connate	Highly connate at base	Contiguous, occasionally connate at base
Calyx segments, form, apex	Shortly bipartite to bifid, occasionally emarginate	Deeply bipartite	Bipartite
Calyx, tooth/total height ratio	1/2–1/3(1/5)	1/2 –2/3(3/4)	$\leqslant$ 1/2
Calyx, base hair-covering	Scarcely hairy to glabrescent, glandular hairs $\leqslant$ 0.2 mm	+/– hairy, glandular hairs $\leqslant$ 0.5 mm	+/– hairy, glandular hairs $\leqslant$ 0.3 mm
Calyx, tooth hair-covering	Glandular hairs $\leqslant$ 0.6 mm	Glandular hairs $\leqslant$ 0.5 mm	Glandular hairs $\leqslant$ 0.4 mm
Corolla, shape	Tubular	Tubular to slightly infundibuliform, slightly narrowed below insertion of filaments	Slightly infundibuliform, narrowed below insertion of filaments
Corolla, dorsal line	Straight to slightly curved	Uniformly curved	Uniformly curved
Corolla, base hair-covering	Glabrescent, short glandular hairs < 0.2 mm	Hairy, short glandular hairs $\leqslant$ 0.2 mm, +/– abundant	Glabrescent, very short glandular hairs < 0.05 mm
Corolla, limb hair-covering	Glandular hairs $\leqslant$ 0.3 mm	Glandular hairs $\leqslant$ 0.5 mm	Glandular hairs $\leqslant$ 0.2 mm
Corolla, colour	Yellowish to creamy	Yellowish or yellowish–brown with a red tinge	Yellowish or yellowish–brown with a red tinge
Adaxial filament insertion above corolla base (mm)	(3)4.5–6	(3)4–5(6)	(2)3–4(5.5)
Abaxial filaments, margin base	Straight	Straight	Auriculate
Filaments, hair covering in lower half	Densely pubescent	Densely pubescent	Scarcely or minutely pubescent
Filaments, hair length in lower half (mm)	0.3–0.7	0.5–1.2	0.1–0.5
Anthers, length (mm)	1.5–1.9	(1.8)2–2.2(2.5)	(1.8)1.9–2.1(2.5)
Host	*Echinops ritro* L. *E. sphaerocephalus* L.	*Centaurea scabiosa* L. *C. nigra* L.	*Centaurea aspera s.l.* *C. ornata* Willd. *Rhaponticoides alpina* (L.) M. V. Agab. & Greuter

O. ritro can be easily distinguished from *O. salviae* mainly by its calyx segments shortly bipartite to bifid, with triangular teeth (*vs*. entire or unequally bidentate, with acuminate often sub-filiform teeth in *O. salviae*); corolla straight or occasionally slightly curved, tubulose (*vs*. corolla leaning forward conspicuously curvate,

tubulose slightly enlarged above the insertion of the filaments); corolla margin glabrous or glabrescent (*vs*, corolla margin hairy); ovary glabrescent (*vs*, ovary very hairy). Consequently, we consider that these are two different taxa and that the subordination by Nyman (1881: 560) of *O. ritro* to *O. salviae* (*O. salviae* subsp. *echinopis*) is not consistent. In addition no other author has considered them as related species.

Compared to *O. elatior*, *O. ritro* has a thinner, only slightly swollen stem at base (8–10 mm); sub-imbricate to sparse basal leaves; widely lanceolate to ovate upper leaves; free, rarely connate calyx segments that are shortly bipartite to bifid, occasionally emarginate, and have a scarcely hairy to glabrescent base with glandular hairs up to 0.2 mm (Fig. 2); corolla with a straight to slightly curved dorsal line and short glandular hairs up to 0.3 mm; staminal filaments with hairs 0.3–0.7 mm at base; and usually shorter anthers (1.5–1.9 mm) (Table 1).

Orobanche ritro can also be considered close to *O. icterica* on the grounds of some similarities in appearance, spike density, leaf size, corolla length, stigma colour and, occasionally, overall plant colour. However, *O. ritro*, can be easily distinguished by its having sub-imbricate to sparse basal leaves; a usually longer [10-16 (19) mm] calyx, shortly bipartite to bifid, occasionally emarginate calyx segments, and scarcely hairy to glabrescent base with glandular hairs up to 0.2 mm (Fig. 2); tubular corolla with a straight to slightly curved back with short (< 0.3 mm) glandular hairs; densely pubescent staminal filaments with hairs 0.3–0.7 mm at base, adaxial filaments being inserted at slightly greater heights [(3)4.5-6 mm above corolla base] and non-auriculate abaxial filaments with a straight margin; and usually shorter (1.5–1.9 mm) anthers (Table 1).

There are also some differences between host plants. Thus, *O. ritro* parasitizes *Echinops* species, whilst *O. elatior* and *O. icterica* tend to parasitize various *Centaurea* and *Rhaponticoides* (Asteraceae) species.

Although it shares some characteristics with *O. elatior* and *O. icterica*, major morphological differences between these taxa warrant recognizing of *O. ritro* as a separate species.

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Appendix 1

Herbarium specimens of *Orobanche ritro* Gren. & Godr. studied FRANCE: Rabou près Gap, sur l'*Echinops ritro*, 14-VIII-1848, *Grenier*, *s.n*., P; Rabou Lagarde, VII-1854, *Blanc, s.n*., P; Gap, 1857, *Grenier, s.n*., W 14149; Gap, Coréo, chemin de Rabou, 21-VII-1861, *Burle*, *s.n*., W; HUNGARY: Inter Lepsény et Siófok ad Pelsionem lacum in radicibus *Echinopis*, s/f, *Staub, s.n*., COI; PRC; WU 667 (sub *O. major*); Liofok [Siófok] (comté de Wesprem), prés sablonneux sur les bords du Balaton, parasite sur les *Echinops*, 16-VII-1884, *Hermann*, *s.n*., MA 170768; WU 1628 (sub *O. echinops*); Sivkof, Veszprim, 16-VII-1884, *Hermann*, *s.n*., PRC; WU 1108 (sub *O. echinopis*); Erin Cotta Albenoi e vineis e radice *Ulmus campestris*, 27-VII-1869, *J. Tauscher, s.n*., WU (sub *O. elatior* Sutton by Beck); ROMANIA: Agri Romanorum in Banatu loco Fontina fetje dicto supra *Echinops*, VII-1857, *J. Pančić*, *s.n*., BEOU (sub *O. echinopis*, corrected by Beck as *O. major*) [digital image]; Agri Romanorum loco Vakarec dicto in Banatu, VII-1867, *J. Pančić*, *s.n*., BEOU (sub *O. echinopis* corrected by Beck as *O. major*) [digital image]; In arenosis ad Vakarec, Banatu, VII, *J. Pančić*, *s.n*., PAD 7791 (sub *O. echinopis*) [digital image]; Ad vallum Romanorum legionum Serbio-banaticae, VI-1869, *Sonklar*, *s.n*., WU 771 [sub *O. ritro* G. G. / *Echinopis* Pančić, corrected by Beck as gr. *O. major* L.]; RUSSIA: Fl. Sareptana, 1853, *Becker*, *s.n*., W 42435 (sub *O. elatior*); SERBIA: Prope oppidum Nisch, VII-1883, *S. Petrovic*, *s.n*., PRC (sub *O. echinopis*); SPAIN: Huesca, Ortilla, cerca del corral Purrudán, 30TXM9969, 555 m, 8-VI-1996, *J.V. Ferrández*, *s.n*., JACA 344296 (sub *O. lutea* Baumg); Huesca, Barbastro, Pr. Torre Joaquina, yesos, sobre *Echinops ritro*, 31TBG6452, 360 m, 22-V-2003, *J.V Ferrández, s.n*., JVF 13303 (sub *O. cf. elatior*); Huesca, Almunia de San Juan, al E de Valmayor, yesos, claro de carrascal y sarda, sobre *Echinops ritro*, 31TBG7445, 400 m, 21-VI-2004, *J.V. Ferrández*, *s.n*., JVF 10404; Zaragoza, Calatayud, Marivella, 25-V-1908, *Vicioso*, *s.n*., MA 436911.