

F. Verloove, E. Laguna, P. P. Ferrer-Gallego, J. Fabado, D. Guillot Ortiz & F. Leliaert

Updates on the vascular flora of Castellón and Valencia (Valencian Community, Spain)

Abstract

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Fieldwork in the autumn of 2023 in the Spanish provinces of Castellón and Valencia yielded some interesting plant records, mainly (but not exclusively) of non-native taxa. Their degree of naturalization varies from ephemeral garden escapes (such as *Clerodendrum trichotomum* or *Erythrina crista-galli*) to well-established, fast-spreading weeds (such as *Chloris truncata*). *Arthraxon hispidus* is reported for the first time in Spain.

Key words: Chorology, Iberian Peninsula, casual, invasive.

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Introduction

The flora and vegetation of the Valencian Community are particularly well studied, both in terms of native and non-native species. Moreover, the available information is up-to-date: the fifth and penultimate part of the Flora Valentina (Mateo & al. 2011-2015, 2022-2024) was only recently published (Mateo & al. 2024). The data regarding the local non-native flora are also recent: a very detailed overview of the alien flora, including identification keys and distribution maps (and not only for the Valencian area but for the whole of Catalonia) was recently published as a doctoral thesis (Gómez-Bellver 2023).

Notwithstanding this, interesting plant discoveries can still be made even in well-studied areas. Especially in regions with high anthropogenic pressure (densely populated, subject to intense economic activities or tourism), the flora is permanently changing: new alien species are constantly being introduced, whether intentionally or not. It is also interesting to monitor the behavior of species that are already present: their status (ephemeral to naturalizing to naturalized to invasive) can change quickly. Ornamental plants that were deliberately introduced in the past may begin to escape from cultivation, which could be

the first step toward an incipient future naturalization or even invasion. Also, increased knowledge regarding difficult species groups (including the application of genetic research) may shed new light on the identity of some taxa.

It is with this approach that intensive fieldwork was carried out in the autumn of 2023 in the provinces of Castellón and Valencia. This article discusses the findings made as a result. Although the initial focus was on non-native species, some observations of native species are also discussed. The status of some taxa (native *vs* non-native) is very uncertain.

Materials and methods

The records here presented are the result of fieldwork by the first author conducted between 29 August and 11 September 2023. On that occasion, numerous localities were explored throughout the provinces of Castellón and Valencia, especially along the coast and in the lowland areas. The focus was on riparian and anthropogenic, often urban habitats (such as port and industrial areas, railway infrastructure, roadsides, parks, etc.), agricultural fields (including the numerous fruit growing areas and rice fields), etc. The other authors contributed with recent and/or unpublished personal records and/or provided further information useful to this study.

Herbarium specimens were collected for most records and these are preserved in the herbaria of the Meise Botanic Garden, Belgium (BR) and/or of the University of Valencia, Spain (VAL). Specimens deposited in BR will be soon be made available online at <https://www.botanicalcollections.be/>. Records for which no herbarium material was collected are supported by photographs. All records, including the photographs, were also registered on the observation.org online platform (<https://observation.org/>), an EU-based platform for biodiversity citizen science and monitoring. These data are available as Electronic Supplementary File 1 of this article and were subsequently also loaded into GBIF (Global Biodiversity Information Facility; <https://www.gbif.org/>).

The nomenclature in this paper follows Plants of the World Online (POWO 2024), except for *Gamochoaeta*.

The presence or absence of each taxon and its rarity were verified by consulting the Biodiversity Database of the Valencian Community (Banco de Datos de Biodiversidad de la Comunidad Valenciana, <https://bdb.gva.es>).

For two taxonomically challenging taxa, a putative *Commelina* species (here identified as *Arthraxon hispidus*) and a species of *Eleocharis*, molecular phylogenetic analyses were employed to aid species identification and assess possible geographical origins. For *Arthraxon*, we analyzed the plastid encoded *trnL-F* spacer (Skendzic & al. 2007, Arthan & al. 2017, Lee & al. 2022). For *Eleocharis*, we analyzed the nuclear rDNA internal transcribed spacer (ITS) region following Roalson & Friar (2000) and Roalson & al. (2010), as well as the plastid encoded *matK* gene. Total genomic DNA was extracted from silica-dried leaf material using a modified CTAB protocol. The ITS region was amplified using primers ITS4 (5'-TCCTCCGCTTATTGATATGC-3') and ITS5 (5'-GAAG-TAAAAGTCGTAACAAGG-3') (White & al. 1990); *matK* was amplified using primers matK-MALPR1 (5'-ACAAGAAAGTCGAAGTAT-3') and *matK-xF* (5'-TAATTTAC-

GATCAATTCATTC-3') (Ford & al. 2009; Dunning & Savolainen 2010); *trnL-F* was amplified using primers *trnL-c* (5'-CGAAATCGGTAGACGCTACG-3') and *trnL-f* (5'-ATTTGAACTGGTGACACGAG-3') (Taberlet & al. 1991). PCR conditions are described in detail on the open-access repository Zenodo (10.5281/zenodo.12731814). PCR quality control was performed with a BioAnalyzer (Agilent Inc.). After purification using ExoSAP-IT (ThermoFisher Scientific), PCR products were sequenced by Macrogen (Seoul, South Korea). Forward and reverse sequences were assembled using Geneious Prime v2023.2.1. (Biomatters, Auckland, New Zealand). Sequences have been deposited in the European Nucleotide Archive (ENA) under project number PRJEB77568 (<https://www.ebi.ac.uk/ena/browser/view/PRJEB77568>) and accession numbers OZ119296 (*Arthraxon hispidus*, *trnL-trnF* IGS), OZ174342-OZ174346 (*Eleocharis* sp. pl., *matK* and ITS). Sequence datasets were constructed, including the sequences generated in this study and publicly available sequences obtained from ENA/GenBank, including the sequences from the abovementioned publications and closest BLAST hits. Sequences were aligned using MUSCLE (Edgar 2004). Phylogenetic relationships were reconstructed using maximum likelihood and 1000 ultrafast bootstrap replicates in IQ-TREE 2.2.2.7 (Nguyen & al. 2015) on the CIPRES Science Gateway portal (Miller & al. 2010). Sequence alignments are available from Zenodo (10.5281/zenodo.12731814).

Results

Arthraxon hispidus (Thunb.) Makino (*Poaceae*) (Fig. 1a)

New to Spain.

Local status: casual alien weed.

Origin: Tropical Africa, Indian Ocean islands and from western Asia to Australia.

Herbarium specimens: Castellón de la Plana, Paseo Rio Nilo, weed in ornamental plantation, a single individual, 3.9.2023, *F. Verloove 14917* (BR0000027060391V).

Arthraxon hispidus is distinctive in its lanceolate to oblong leaves with auriculate-clasping bases and its creeping habit, with stems rooting at lower nodes (see illustrations in Nesom 2011). Vegetatively, it superficially resembles a species of *Commelina*, for which the Castellón individual was initially erroneously taken. However, the presence of a ligule excluded *Commelina*. Moreover, *trnL-trnF* spacer sequences were identical to those of *A. hispidus* plants from Korea, China, Thailand and Mexico published in previous studies (Skendzic & al. 2007; Arthan & al. 2017; Lee & al. 2022) (Fig. 2) confirming the species identity. This species is weedy throughout its distribution range and locally invasive in areas where it was introduced, in particular in parts of North America (Kiger 1971; Nesom 2011).

According to GBIF, the species has only been found a few times in Europe so far and has not (yet) been able to establish itself permanently. Seed of the species commonly occurs as a contaminant in Niger seed (*Guizotia abyssinica*) from East Africa (Hanson 2019), and the species has indeed also been found as a birdseed alien in London (Ryves & al. 1996). In the 1950s, *Arthraxon hispidus* was also found in the Netherlands at a storage of Korean mats. In 1997 it was also seen in the port of Bamberg in Germany where it was probably introduced with granite from China. Finally, the species is also known as a weed



Fig. 1. a) *Arthraxon hispidus* as a plantation weed in Castellón de la Plana in September 2023 (F. Verloove); b) *Bauhinia variegata*, self-sown on the verge of an urban canal in Albal in May 2021 (E. Laguna). These escaped plants are flowering and fruiting, which indicated an incipient local naturalization. c) *Catalpa bignonioides* in Castellón de la Plana (Riu Sec) in September 2023 (F. Verloove). In this dried-out riverbed escaped individuals are not rare and some of them reach the fruiting stage, indicating an incipient naturalization process. d) The Australian *Chloris truncata* in Nules in September 2023 (F. Verloove). In this area, this species has become a common and fast-spreading roadside weed. e) Escaped individuals of *Clerodendrum trichotomum* in Burriana in September 2023 (F. Verloove). f) *Eleocharis caduca* in Ribesalbes in September 2023 (F. Verloove).

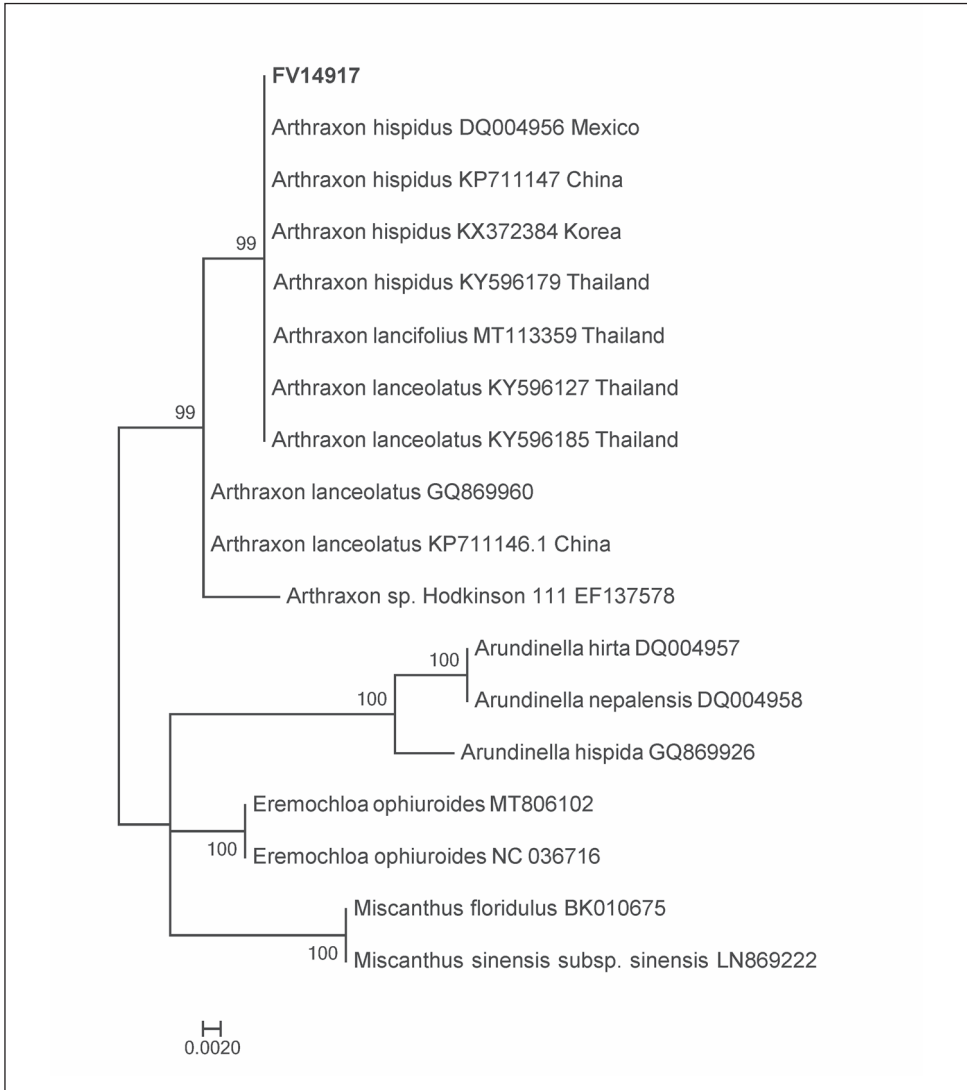


Fig. 2. Phylogenetic tree (trnL-trnF spacer sequences) showing the position of *Arthraxon hispidus* from Castellón de la Plana (coll. FV14917) and from various other provenances (GenBank).

in bamboo tubs (comm. R. Otto, June 2024). Based on these earlier European finds, two possibilities seem most obvious: either the species germinated from birdseed (although no other typical birdseed plants were seen), or (and therefore most likely) *Arthraxon hispidus* was inadvertently introduced with the ornamental plants, including as a stowaway in the complementary substrate that is often used by local plant nurseries; see also Verloove & al. (2014). In the latter case, the species appears to be present in local plant nurseries and

garden centers and thus can be expected in ornamental plantations elsewhere in the region.

In the locality where it was found in Castellón de la Plana in 2023, the species was weeded a few weeks after our observation.

***Bauhinia variegata* L. (Fabaceae) (Fig. 1b)**

New to the provinces of Castellón and Valencia.

Local status: casual escaped ornamental (both provinces) and naturalizing (Valencia).

Origin: Indian subcontinent, China.

Observations:

Castellón province:

Benicasim, Barranc de Farja, vacant lot in residential area, 1.9.2023, *F. Verloove*.

Valencia province:

-Albal, urban plot at Avenida Padre Carlos Ferris and margins of ravine ‘Rambleta del Sord’, both naturalizing specimens that flower and bear fruit, and new seedlings that germinated from nearby planted trees, 6.5.2021 *E. Laguna*, 39° 23’ 55” N, 0° 24’ 18” W

-Albal, Calle Doctor Fleming, seedlings and young plants escaped from nearby planted trees in urban semi-abandoned garden, 15.7.2018, *E. Laguna*, 39° 23’ 44” N, 0° 24’ 34” W

-Valencia, parking lot in front of Hospital San Juan de Dios, seedlings and young plants in semi-abandoned urban tree pits with different tree species, close to planted trees of *Bauhinia variegata*, 8.10.2011, *E. Laguna*, 39° 28’ 39” N, 0° 19’ 50” W

This ornamental species is much planted in urban areas in Spain. It flowers and fruits abundantly and increasingly reproduces from seed. In eastern Spain, however, it was only known from the Alicante province (Gómez-Bellver 2023). It is here first reported from Benicasim in the Castellón province. Scattered self-sown individuals were observed on rough ground, close to planted individuals. It is also reported for the first time for Valencia, including older, unpublished data of seedlings and young plants emerging from nearby planted trees in Valencia and Albal, as well as more recent observations of specimens already producing flowers and fruits in Albal. At least in this last locality *Bauhinia variegata* appears to be in the process of naturalization.

***Catalpa bignonioides* Walter (Bignoniaceae) (Fig. 1c)**

New to the province of Castellón.

Local status: naturalizing escaped ornamental.

Origin: southeastern U.S.A.

Observations: Castellón de la Plana, Riu Sec, dried-out riverbed, 1.9.2023, *F. Verloove*; La Vall d’Uixó, Riu de la Font de San Josep, dried-out riverbed, 10.9.2023, *F. Verloove*.

This ornamental tree is regularly recorded as an escape from cultivation in northeastern Spain but it is generally considered to be an ephemeral species (Gómez-Bellver 2023). In the Castellón province, from where it was not yet known, it locally seems to be in the process of naturalization, especially in dried-out riverbeds. In Castellón de la Plana, self-sown flowering and fruiting individuals were observed in the Riu Sec valley, suggesting that the species is able to build up a self-sustaining population. Interestingly, the escape of this species in the Riu Sec riverbed in Castellón was already observed in 2019 by one of the authors (DGO). A similar incipient naturalization process was observed in the Barranc de Sant Josep in La Vall d’Uixó.

Chloris truncata R.Br. (*Poaceae*) (Fig. 1d)

New to the provinces of Castellón and Valencia.

Local status: naturalized weed.

Origin: Australia.

Herbarium specimens: Nules, L'Estany, roadsides, very common in this area, 31.8.2023, *F. Verloove* 14870 (BR0000027060575V); Villareal, N-340 near Camí de Sant Jordi, gravelly roadside, under crash barrier, very common, 11.9.2023, *F. Verloove* 14889 (BR0000027058534V, dupl. VAL).

Observations: Nules, Camí del Cabeçol, in chicken run, ca. 100 individuals, 31.8.2023, *F. Verloove* ; Nules, Camí de la Serratella, roadside, 31.8.2023, *F. Verloove*; Nules, Carretera de la Segona Andana del Rajolí, roadside, omnipresent, 31.8.2023, *F. Verloove*; Nules, Camí de la Mar, roadside, 4.9.2023, *F. Verloove*; Nules, Camí de Nules a Moncofa, roadside, 4.9.2023, *F. Verloove*; Nules, CV-2262 SW of the village, roadside, 4.9.2023, *F. Verloove*; Nules, Avinguda de València × Camí de Nules a Moncofa, roadside, 6.9.2023, *F. Verloove* ; Nules, Avinguda de València, roadside, omnipresent, 6.9.2023, *F. Verloove*; Valencia, V-30 motorway alongside Riu Túria, under crash barrier, very common, 8.9.2023, *F. Verloove*; Nules, CV-2262 roundabout SW of the village, roadside, 10.9.2023, *F. Verloove*; Villarreal, N-340 road, under crash barrier, very common, 11.9.2023, *F. Verloove*.

This Australian grass species is a recent newcomer in Spain. It was probably first recorded in Cambrils (Tarragona) in 2003 (Verloove 2005). Subsequently, it was also found near Barcelona (Sánchez Gullón & Verloove 2015, Verloove & Aymerich 2020), Cáceres (Vázquez 2008), again in Tarragona (Verloove & al. 2019) and in Sevilla (Sánchez Gullón & al. 2020). At present, it is still considered to be ephemeral in the Iberian Peninsula (Velayos 2020). However, in reality, it is a fast-spreading naturalized alien. Since it is usually found along roadsides, often under crash barriers, it is probably often overlooked. Given the species' actual presence in the surroundings of Nules, Valencia and Villarreal, it either must have been overlooked for quite a long time, or must have spread very prolifically. Google Streetview images were verified in some locations where the species is very abundant. Although it cannot be assessed with absolute certainty (images are not always available for every relevant time of year, sometimes mowing has just taken place or the images are simply not sharp enough), the species seems to have only been visible since 2021, which suggests a very rapid expansion indeed. Like the following species, *C. truncata* is very easily wind-dispersed.

Chloris truncata is a well-known troublesome weed and it has been shown that Spain falls within the areas that are climatologically very suitable to this species (Michael & al. 2012). During our recent field work the species was also observed on the verge of agricultural fields, especially in the Nules area. Tolerance mechanisms to glyphosate in a *C. truncata* population from Extremadura are currently being investigated (comm. Joel Torra Farré, Lleida).

Chloris virgata Sw. (*Poaceae*)

New to the province of Castellón.

Local status: naturalized weed.

Origin: Central and South America, southern U.S.A.

Herbarium specimens: Benicasim, former railway track (now Via Verde) at Barranc de

Farja, roadside, scattered small populations, 11.9.2023, *F. Verloove 14864* (BR0000027060544V); Oropesa del Mar, Avenida Central, roadsides, 11.9.2023, *F. Verloove 14868* (BR0000027060568V).

Chloris virgata was probably first recorded from Spain by Mateo & Pyke (1998) and Vallverdú (2000), from the Zaragoza and Tarragona provinces respectively. Its persistence and spread in Cambrils (Tarragona) was subsequently reported by Verloove & Sánchez-Gullón (2008). At present, it is still considered to be ephemeral in the Iberian Peninsula (Velayos 2020). However, it is at least locally naturalized in northeastern Spain (Gómez-Bellver 2023); the recent records in Benicasim and – particularly Oropesa – seem to confirm this.

In the two aforementioned nearby coastal cities in Castellón, *C. virgata* occurs along roadsides. With its lemmas of the fertile floret that are crowned with a hairy pappus, it is very easily wind-dispersed. A future local expansion is therefore likely.

Previous observations of the genus *Chloris* in Valencia and Castellón were consistently attributed to the only known taxon of the local flora (see Mateo & Crespo, 2014), *C. gayana* Kunth. Because this species superficially resembles *C. virgata*, the two may have been confused with each other in some cases.

Clerodendrum trichotomum Thunb. (*Lamiaceae*) (Fig. 1e)

New to the province of Castellón.

Local status: casual escaped ornamental.

Origin: East Asia.

Herbarium specimens: Burriana, Cami del Rajoli, border of concrete canal, escaped but planted nearby, 10.9.2023, *F. Verloove 14874* (BR0000027060490V).

This ornamental shrub is only exceptionally recorded as an escape from cultivation in Spain, perhaps so far only from Sallent in the province of Barcelona (Aymerich 2016).

In Burriana three young individuals were observed in the joints of concrete of a small canal. A flowering and fruiting parental shrub was observed nearby.

Cyperus brevifolius (Rottb.) Hassk. (*Cyperaceae*)

New to the province of Valencia.

Local status: casual alien weed.

Origin: tropics and subtropics.

Herbarium specimens: Valencia, enclosed garden on the side of the school Jesús y María, in Literat Gabriel miró street, 30S 729201 4376825, 15 m, 3.9.2023, *J. Fabado* (VAL 252804).

This pantropical species is known from a few provinces in the Iberian Peninsula (Castroviejo, 2007), all in the south and west of the Peninsula. In the locality where it was found in Valencia in 2023, it is a weed in an ornamental plantation, with hundreds of individuals. In 2024 its presence was confirmed in early July. The lawn is mowed periodically, but the plant grows back vigorously.

Digitaria ciliaris (Retz.) Koeler (*Poaceae*)

New to/confirmed from the province of Castellón.

Local status: naturalized weed.

Origin: Old World tropics and subtropics.

Herbarium specimens: Castellón de la Plana, El Grau, Parc El Pinar, lawn weed, 1.9.2023, *F. Verloove 14916* (BR0000027060520V); Castellón de la Plana, Parque Manuel Babiloni, lawn weed, leaves unusually wide and hairy, 2.9.2023, *F. Verloove 14942* (BR0000027060506V, dupl. VAL); Castellón de la Plana, Parque Manuel Babiloni, plantation weed, 2.9.2023, *F. Verloove 14943* (BR0000027060513V, dupl. VAL).

Digitaria ciliaris is a poorly known species that is still frequently confused with *D. sanguinalis* (L.) Scop. It is distinguished by its spikelets with the lower lemma with smooth veins (in *D. sanguinalis* the lateral veins of the lower lemma are scabrous). Gómez-Bellver (2023) did not report it from Castellón, contrary to Alonso & Crespo (2020). Its presence in that province is here confirmed. In the Castellón de la Plana area, *D. ciliaris* was recorded on several occasions, not only as an urban weed in parks but also as a roadside weed in the port area. It is clearly naturalized but apparently widely overlooked.

***Digitaria violascens* Link (*Poaceae*)**

New to the province of Castellón.

Local status: naturalized weed.

Origin: Tropical & Subtropical Asia, Australia.

Herbarium specimens: Castellón de la Plana, Parque Manuel Babiloni, weed in flowerbeds, etc., 2.9.2023, *F. Verloove 14881* (BR0000027058510V); Castellón de la Plana, Calle del Rio Jucar, irrigated lawns, very common, 3.9.2023, *F. Verloove 14890* (BR0000027058541V, dupl. VAL).

Digitaria violascens is a recent but increasing weed in Spain. Since the first observations in 2007 (Verloove & Sánchez-Gullón 2008), it has been recorded from the provinces of Barcelona, Cádiz, Huelva, Lérida, León, Pontevedra, Tarragona and Zaragoza (Alonso & Crespo 2020).

It is here reported for the first time from the province of Castellón where it is found in similar circumstances as elsewhere in southern Europe, i.e. as a weed of irrigated lawns and flower beds.

***Diplachne fusca* subsp. *uninervia* (J.Presl) P.M.Peterson & N.Snow (*Poaceae*)**

New to the province of Castellón.

Local status: naturalized (?) weed.

Origin: Central and South America, southern U.S.A.

Herbarium specimens: Castellón, El Grau, Platja del Pinar, beach, mouth of small stream, not rare but only locally, 1.9.2023, *F. Verloove 14883* (BR0000027058527V, dupl. VAL).

Several dozen individuals were recorded on both sides of the mouth of a small stream and along a nearby track in coastal dunes in El Grau de Castellón. In this locality, this taxon looks well-established but it was not seen in other localities in the surroundings.

Diplachne fusca is represented by two subspecies in the Iberian Peninsula: in addition to subsp. *uninervia* (usually with the inflorescence completely exerted from the uppermost leaf sheaths), also subsp. *fascicularis* (Lam.) P.M.Peterson & N.Snow is found (with panicles usually partially enclosed) (Aedo 2020). Both are relatively recent

newcomers and in the process of spreading, particularly as weeds in rice fields (del Monte & Cortés 2000).

Eleocharis caduca (Delile) Schult. (*Cyperaceae*) (Fig. 1f)

New to the province of Castellón.

Local status: naturalized weed (or native?).

Origin: Mediterranean area, Africa.

Herbarium specimens: Ribesalbes, embassament de Sitjar, exposed pond margin, very common, 7.9.2023, F. Verloove 14912 (BR0000027059579V, dupl. VAL).

Eleocharis caduca is a poorly known species with main distribution in tropical Africa, but with some isolated occurrences further north, especially in the Mediterranean, e.g. in Crete (Greuter & al. 2002). In the Iberian Peninsula it has been confused with the New World species *E. flavescens* (Poir.) Urb. for quite a long time (Verloove & Sánchez Gullón 2010). It is in fact less rare than the latter but most records are from Portugal. *E. caduca* was collected once, in 1971, in Ibiza and it is unknown what status should be assigned to this record (native vs alien).

In Ribesalbes, on the exposed banks of the Sitjar water reservoir, *E. caduca* was found in large numbers, along with – among others – *Bolboschoenus maritimus* (L.) Palla and *Cyperus flavidus* Retz. In contrast with *E. flavescens* nutlets in this species are shiny black. In addition, the leaf sheath apex is not prominently hyaline and wrinkled, a characteristic feature of *E. flavescens*.

Due to the complexity of the group, the plants found in Ribesalbes underwent molecular phylogenetic analyses using ITS and *matK* sequences. These sequences were compared with previously collected samples of *Eleocharis caduca* and *E. flavescens* from the Iberian Peninsula, as well as with samples of *E. flavescens* from America and other regions (accessions from GenBank). The ITS and *matK* markers (Fig. 3) support the hypothesis, previously suggested by Verloove & Sánchez Gullón (2010) based on morphological data, that two closely related but distinct taxa are present in Spain and Portugal.

Eragrostis virescens J.Presl (*Poaceae*)

New to/confirmed from the province of Valencia.

Local status: casual (?) weed.

Origin: New World.

Herbarium specimens: Alboraya, camí de les Vinyes, roadsides, 22.10.2023, P.P. Ferrer-Gallego s.n. (VAL 252816, dupl. BR).

Eragrostis virescens is a poorly known species that is still frequently overlooked. Gómez-Bellver (2023; sub *E. mexicana* (Hornem.) Link) did not report it from Valencia, contrary to Sánchez Gullón & al. (2020). Its presence in that province is here confirmed, although its status remains uncertain. In Alboraya only a few individuals were observed in a dried-out concrete canal bordering a rice field. However, given its weedy nature, it may well be more widely dispersed in that area.

Erythrina crista-galli L. (*Fabaceae*) (Fig. 4a)

New to the province of Valencia (and probably to Spain as well).

Local status: casual escaped ornamental.

Origin: South America.

Herbarium specimens: Alboraya, Barranc de Carraixet, near its estuary, concrete slope next to river, a single self-sown individual, 6.9.2023, *F. Verloove 14863* (BR0000027060537V).

A single self-sown, non-flowering individual was found on the fortified bank of the Carraixet river, close to its estuary. No putative parent trees were observed in the vicinity but this species is widely grown as an ornamental in Spain (Sánchez de Lorenzo Cáceres 2003). To our knowledge, *Erythrina crista-galli* had not been recorded before as an escape in Spain. It was recently recorded for the first time in the wild in Madeira (Verloove & Silva Gonçalves 2022). In riparian habitats, *E. crista-galli* is often invasive, for instance in New South Wales, Australia (Smith 1996). In Alboraya, it is an ephemeral species, unless yet undiscovered specimens are occurring nearby.

Species of *Erythrina* are not easily identified, especially if flowers and fruits are missing. The plant was identified using the keys in McClintock (1953), Sánchez de Lorenzo Cáceres (2003) and Nesom (2015).

Euphorbia davidii Subils (*Euphorbiaceae*)

New to the province of Castellón.

Local status: naturalized (?) weed.

Origin: disjunct in Southwestern U.S.A. and Argentina.

Herbarium specimens: Villareal, AP-7 motorway at Cami de Betxi, dried-out ditch, a small population, ca. 100 individuals, 2.9.2023, *F. Verloove 14879* (BR0000027058497V).

a, A small population was detected in a dried-out ditch bordering the AP-7 motorway near Villareal. *Euphorbia davidii* is a recent newcomer in Spain that was probably first recorded from the province of Barcelona (Pyke 2008; early records were erroneously ascribed to *E. dentata* L.). Since then, it has been recorded on a few other occasions from the same province (Aymerich & Sáez 2015, Gómez-Bellver & al. 2016, Gómez-Bellver 2023). These are probably the only records in Spain to date, although the species is an upcoming weed in several parts of southern Europe (see e.g. Barina & al. 2012).

Euphorbia hypericifolia L. (*Euphorbiaceae*) (Fig. 4b)

New to the province of Castellón.

Local status: naturalized (?) weed.

Origin: Central and South America, southern U.S.A.

Herbarium specimens: Castellón de la Plana, Ronda Norte, weed in flowerbed, several dozens, 1.9.2023, *F. Verloove 14915* (BR0000027059678V).

Three ‘chamaesyces’ with erect stems are currently found in the northeastern Iberian Peninsula (Gómez-Bellver 2023) and they all look similar in gross morphology. *Euphorbia nutans* Lag. is the oldest introduction; it used to be more or less widespread but might be declining lately, in favor of the other two species. Its stems and leaves are hairy and its capsules exceed 2 mm in diameter. The other species, *E. hypericifolia* and *E. hyssopifolia* L., are recent introductions but they are increasing in recent years (see Laguna & al. 2017). Both are much less hairy (*E. hyssopifolia*) to glabrous (*E. hypericifolia*) and have distinctly smaller capsules. *E. hyssopifolia* is characterized by slender, few-flowered inflorescences, while in *E. hypericifolia* the flowers are densely clustered.

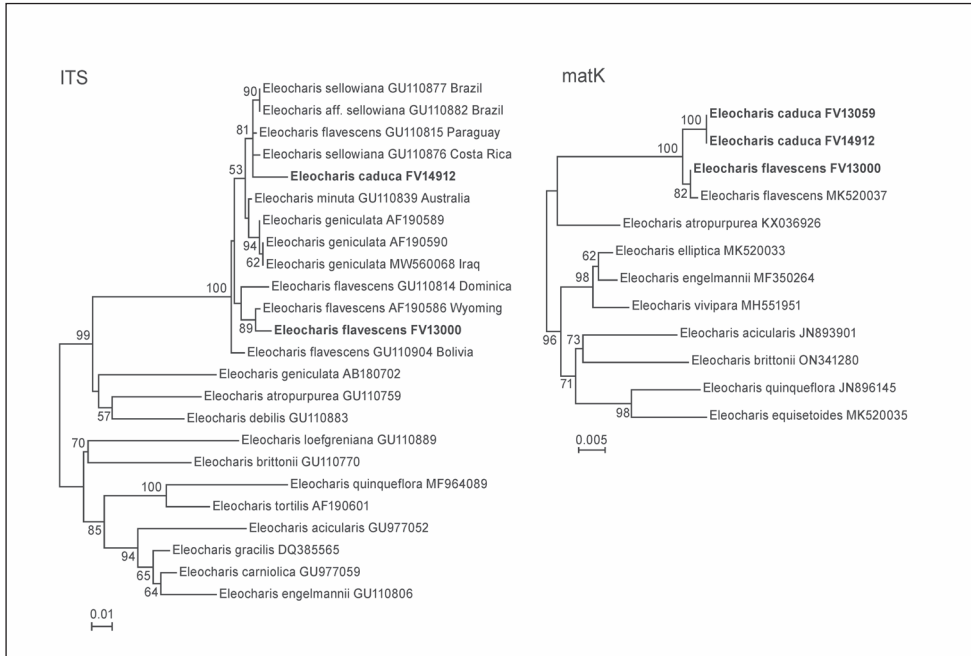


Fig. 3. Phylogenetic tree (ITS and *matK* spacer sequences) showing the position of *Eleocharis caduca* from Ribesalbes (coll. FV14912) and from various other provenances (GenBank), incl. previous collections from the Iberian Peninsula of that species (FV13059) and of the closely related *E. flavescens* (FV13000).

Plants that were recently found as weeds in a flowerbed in Castellón de la Plana are completely glabrous, have distinct stipules that are longer than 1,5 mm and very small capsules; these characteristics refer to *E. hypericifolia* (e.g. Chen 2004), a species that was not yet known from the Castellón province (Gómez-Bellver 2023).

***Gamochaeta coarctata* (Willd.) Kerguélen (*Asteraceae*) (Fig. 4c)**

New to the province of Castellón.

Local status: naturalized (?) weed.

Origin: Central and South America, southern U.S.A.

Herbarium specimens: Castellón de la Plana, Parque de Don Ramón James Boera, in gravel, ca. 200 individuals, 3.9.2023, *F. Verloove* 14898 (BR0000027058466V, dupl. VAL).

In northeastern Spain *Gamochaeta coarctata* was only known from the provinces of Barcelona and Gerona, where it is a recent introduction (Gómez-Bellver 2023). In Castellón de la Plana, it is an urban weed in a park; it should be looked for elsewhere in the area.

Gamochaeta coarctata belongs to a complex of closely related species that is probably best treated as a single, variable species, *G. americana* (Mill.) Wedd. (Freire & al. 2021). It also includes the recently described *G. impatiens* Nesom (Nesom 2022).

Malvastrum coromandelianum (L.) Garcke (*Malvaceae*) (Fig. 4d)

New to the provinces of Castellón and Valencia.

Local status: naturalized (?) weed.

Origin: Central and South America, southern U.S.A.

Herbarium specimens: Oropesa del Mar, Barranc de la Rampuda, dried out, gravelly riverbed, common, many dozens over a distance of ca. 300 m, 11.0.2023, *F. Verloove* 14871 (BR0000027060582V, dupl. VAL); Valencia, Valencia city, Enguera street, urban garden tree pits, 10.10.2023, *P.P. Ferrer-Gallego* s.n., VAL 255201 (dupl. BR); idem, 18.10.2023, *J. Fabado* s.n., VAL 252817.

Malvastrum coromandelianum was recorded for the first time in Spain in 2007 in Huelva, as an ephemeral alien (Verloove & Sánchez-Gullón 2008). More recently it was also observed, for several years, in a garden in Vilablareix in Girona (Gómez-Bellver 2023). During our recent field work, apparently stable populations of this species were observed in two localities. In Oropesa del Mar, many dozen individuals were observed in a dried-out river bed, over a distance of ca. 300 m. Specimens were found in flowering and fruiting, abundantly reproducing from seed. It looks as if this species is naturalized in this particular area. It was found along with, among others, *Cardiospermum halicacabum* L. and other species that are regularly observed from sewage sludge. In Valencia, this species has been collected in several tree basins in garden areas on Enguera street, where the plants produce numerous seeds.

Interestingly, some morphological variation has been observed in the area under study. While the plants from Oropesa del Mar belong to the nominal subspecies, those from Valencia are atypical in having unusually large leaves with 4-rayed hairs on the upper surface (*vs* most or all hairs simple) and flowers in dense, interrupted clusters (*vs* most flowers solitary and axillary). Such plants are distinguished as *M. coromandelianum* subsp. *capitatospicatum* (Kuntze) S.R.Hill. This taxon was recently also recorded from La Palma in the Canary Islands (Otto & Verloove 2016) and from Saudi Arabia and the United Arab Emirates (Thomas & al. 2014, Sakkir & al. 2022).

Tipuana tipu (Benth.) Kuntze (*Fabaceae*) (Fig. 4e)

New to the province of Castellón.

Local status: naturalizing escaped ornamental.

Origin: South America.

Observations: Burriana, Avinguda de Londres, vacant lot in residential area, 30.8.2023, *F. Verloove*; Villarreal, rough ground near to the railway station, 30.08.2023, *F. Verloove*; Castellón de la Plana, Riu Sec, dried-out riverbed, 1.9.2023, *F. Verloove*; Benicasim, Barranc de Farja, dried-out riverbed, 1.9.2023, *F. Verloove*; Castellón de la Plana, Carrer del Riu Sena and Carrer del Riu Nerbion, vacant lots in residential area, several dozens, 2.9.2023, *F. Verloove*; La Vall d'Uixó, Riu de la Font de San Josep, dried-out riverbed, 10.9.2023, *F. Verloove*.

This ornamental tree is much planted in urban settings in the study area. It abundantly reproduces from seeds and is escaping wherever planted. In northeastern Spain, it was not yet known from the Castellón province (Gómez-Bellver 2023). It is, however, like in the surrounding provinces, in the process of naturalization. During our recent fieldwork escaped individuals were recorded in, among others, Benicasim, Burriana, Castellón de la

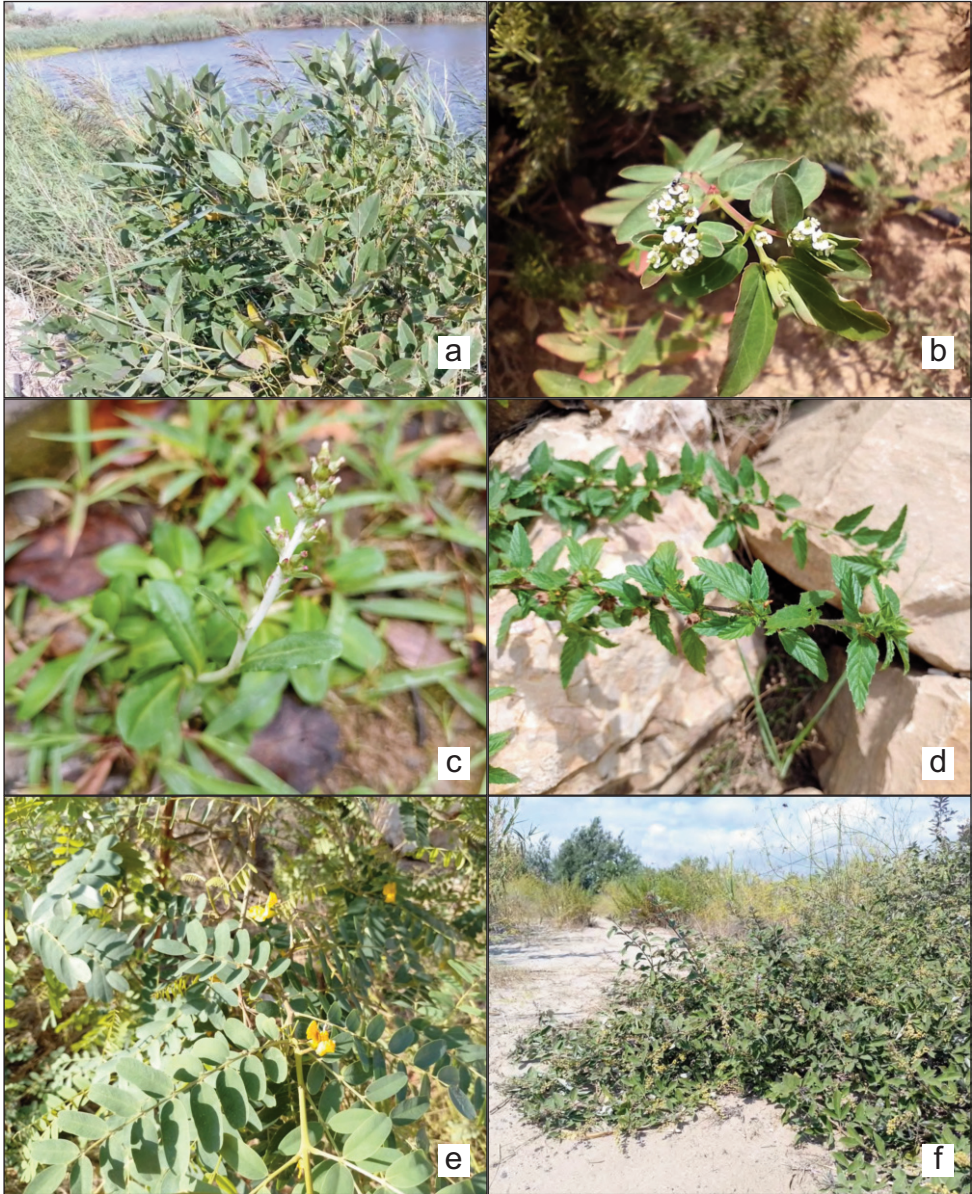


Fig. 4. a) *Erythrina crista-galli*, escaped on the banks of the Carraixet river in Alboraya in September 2023 (F. Verloove); b) *Euphorbia hypericifolia* in Castellón de la Plana in September 2023 (F. Verloove); c) *Gamochaeta coarctata* in Castellón de la Plana in September 2023 (F. Verloove); d) *Malvastrum coromandelianum* in Oropesa del Mar in September 2023 (F. Verloove); e) *Tipuana tipu* in Castellón de la Plana (Riu Sec) in September 2023 (F. Verloove). In this dried-out riverbed escaped individuals are not rare and some of them reached the flowering and fruiting stage, indicating an incipient naturalization process; f) Escaped flowering and fruiting individual of *Vitex trifolia* near the beach in Castellón de la Plana in September 2023 (F. Verloove).

Plana, La Vall d'Uixó and Villareal. It was most often observed on rough ground (vacant lots) in residential areas and in dried-out riverbeds. In the latter type of habitat, for instance in the Riu Sec in Castellón de la Plana, seemingly naturalized populations with flowering and fruit-bearing individuals were seen. Interestingly, the escape of this species in the Riu Sec riverbed in Castellón was already observed in 2019 by one of the authors (DGO).

Verbena officinalis* var. *africana (R.Fern. & Verdc.) Munir (*Verbenaceae*)

New to the provinces of Castellón and Valencia (and probably Spain as well).

Local status: naturalized weed (or native?).

Origin of variety: western Mediterranean area (Morocco), East Africa, Australia.

Herbarium specimens: Villareal, Riu Millars at N-340, dried out riverbed, 02.09.2023, *F. Verloove 14891* (BR0000027058558V).

Observations (for details, also see the herbarium label): Villareal, Riu Millars, dried-out riverbed, 2 and 3.9.2023, *F. Verloove*; Valencia, Tavernes Blanques, Barranc de Carraixet, dried-out riverbed, 6.9.2023, *F. Verloove*.

The infraspecific variability of *Verbena officinalis* in the Iberian Peninsula was not discussed by Pujadas & Plaza (2010). Nonetheless, on the basis of leaf morphology two more or less distinct varieties can be distinguished. Plants with deeply divided leaves with acute to serrate lobes and floral bracts that are usually at least half as long as the calyx are referable to *V. officinalis* var. *africana*. In the nominal variety leaves are merely lobed with obtuse lobes and floral bracts tend to be shorter (Fernandes & Verdcourt 1989, Munir 2002, O'Leary & al. 2010). According to Michael (1997) such plants are best treated as a distinct species, *V. africana* (R. Fern. & Verdc.) P.W. Michael.

In dried-out gravelly riverbeds in Villareal and Valencia populations of *Verbena officinalis* were observed that correspond in all details with var. *africana*. It is unclear, however, whether this is an overlooked native variety or a naturalized alien taxon.

***Vitex trifolia* L. (*Lamiaceae*)** (Fig. 4f)

New to the province of Castellón.

Local status: casual escaped ornamental.

Origin: East Africa (southern Somalia to Mozambique), South Asia and Pacific.

Herbarium specimens: Castellón de la Plana, Riu Sec near the beach, sandy ruderal riverbank, a single shrub, 2.9.2023, *F. Verloove 14880* (BR0000027058503V).

This species is rarely grown as an ornamental shrub in Spain (it is not mentioned for instance by Sánchez de Lorenzo Cáceres 2023). Yet, it was reported as an escape from cultivation in 2013 and 2015 in Alboraya, at the estuary of the Carraixet river (Ferrer-Gallego & al. 2016). In 2024 it turned out that the growing area had recently been destroyed after major works (obs. PFFG).

In similar circumstances, a single flowering and fruiting shrub was recorded in Castellón de la Plana. Like in Alboraya, it belongs to a cultivar called 'Purpurea' with lower leaf surfaces tinged pinkish-purple. No putative parent shrubs were observed in the vicinity.

In the Mediterranean area, *Vitex trifolia* is probably only known from Tunisia where a naturalized population was reported by Hadj Khalifa & El Mokni (2020).

The incipient escape of *Vitex trifolia* should be monitored as the species is an emerging environmental weed in some warm-temperate and subtropical regions (e.g. Cousins & al.

2010, Anderson 2020). However, this usually concerns *V. trifolia* subsp. *litoralis* Steenis, with unifoliolate leaves, which is perhaps better treated as a separate species, *V. rotundifolia* L.f. (Sengun 2017). The latter taxon has recently been recorded as a local invader of beaches in Georgia in the Caucasus (<https://observation.org/observation/256889157/>).

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Addresses of the authors:

Filip Verloove¹, Emilio Laguna², P. Pablo Ferrer-Gallego³, Javier Fabado⁴, Daniel Guillot Ortiz⁵ & Frederik Leliaert¹,

¹Meise Botanic Garden, Nieuwelaan 38, B-1860 Meise, Belgium. E-mail: filip.verloove@plantentuinmeise.be

²Servicio de Vida Silvestre y Red Natura 2000, Centro para la Investigación y Experimentación Forestal (CIEF), Generalitat Valenciana, Avda. Comarques del País Valencià 114, Quart de Poblet, Valencia ES-46930, Spain.

³Servicio de Vida Silvestre y Red Natura 2000, Centro para la Investigación y Experimentación Forestal (CIEF), Generalitat Valenciana, Avda. Comarques del País Valencià 114, Quart de Poblet, Valencia ES-46930, Spain.

⁴Jardín Botánico, Universitat de València, C/ Quart 80, ES-46008 Valencia, Spain.

⁵C/ La Pobleta 7, ES-46118 Serra, Spain.

