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Six records of new and rare alien species to the flora of United Arab Emirates (UAE)

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Summary. The article presents new records for six alien species previously not known or rare from flora of United Arab Emirates (UAE) – *Sagina apetala* Ard., *Stellaria apetala* Ucria (*S. pallida* (Dumort.) P. Fourn.), *Stellaria media* L. (Caryophyllaceae), *Acalypha lanceolata* Willd. (Euphorbiaceae), *Boerhavia erecta* L. (Nyctaginaceae), *Oxalis dillenii* Jacq. (Oxalidaceae). All of these species have been recorded for the first time from the Emirate of Fujairah in north-eastern UAE. *Sagina apetala* and *Stellaria apetala* were found on wet sand around Masafi in the Masafi Friday market, *Acalypha lanceolata* as a weed between plastic pots in Al Qalamoon Nursery in village Al Bidiya, *Boerhavia erecta* a common weed found in different places, such as roadside in a backstreet in Qidfa, as a weed in Salman Nursery in Masafi, on stone-gravel wadi banks near the Masafi Friday market Sur, in a plant nursery between pots Rul Dadhna, at the Salama Plant Nursery in Al Dibba town, as a weed on irrigated plantation, between irrigated lines and without irrigation on abandoned land in the Green Nursery Sales Dibba and on irrigation and weed in and between plastic pots, on sand between irrigated lines in nursery in Al Bidiya; *Oxalis dillenii* was found as a weed in the Masafi Friday market in around Masafi town, as rare weed in Al Shams Nursery and private nursery in 0.2 km South from Al Amerey Nursery in Al Dibba town. These taxa are new for the flora of Fujairah and the UAE. *Stellaria media*, a weed in small garden in Al Dibba and in Masafi Friday market, is rare in the UAE, and new for Fujairah. Species, synonyms, spatial distribution, habitat preferences, and species taxonomy with remarks on identification and differentiation from the most similar taxa occurring in the study area, as well as the list of localities are presented. Herbarium material was transferred to the Herbarium of the Komarov Botanical Institute (LE), duplicates – to the Herbarium of Altai State University (ALTB) and the Scientific Herbarium of Fujairah (FSH, Wadi Wuraya national park, Fujairah, United Arab Emirates).

Шесть новых и редких чужеродных видов для флоры Объединённых Арабских Эмиратов

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Аннотация. В статье представлены новые находки шести ранее неизвестных или редких чужеродных видов во флоре Объединённых Арабских Эмиратов (ОАЭ) – *Sagina apetala* Ard., *Stellaria apetala* Ucria (*S. pallida* (Dumort.) P. Fourn.), *S. media* L. (Caryophyllaceae), *Acalypha lanceolata* Willd. (Euphorbiaceae), *Boerhavia erecta* L. (Nyctaginaceae), *Oxalis dillenii* Jacq. (Oxalidaceae). Все они зарегистрированы впервые в эмирате Фуджейра в северо-восточной части ОАЭ. *Sagina apetala* была обнаружена на мокром песке в окрестностях Мазафи на «Пятничном рынке Мазафи», *Stellaria apetala* – также на «Пятничном рынке Мазафи», *Acalypha lanceolata* – растёт как сорняк между пластиковыми горшками в «питомнике Аль-Каламун» в пос. Аль-Бидия, *Boerhavia erecta* – обычный сорняк в разных местах эмирата – на обочине дороги в переулке в пос. Кидфа, как сорняк в «Питомнике растений Салмана» в Мазафи, дико на каменно-гравийных берегах вади возле «Мазафи Фрайдей Маркет Сур», в питомнике растений между горшками в пос. Рул Дадна, в «Питомнике растений Саламан» в г. Аль-Дибба, как сорное на орошаемой плантации, между поливными рядами и без орошения на заброшенных участках земли в «Зелёном питомнике-распродаже в Диббе» и на поливе и сорняках в и между пластиковыми горшками, на песке между поливными рядами в питомнике в Аль-Бидии, *Oxalis dillenii* был обнаружен как сорняк на «Пятничном рынке Мазафи» в окрестностях г. Мазафи, как редкий сорняк в «Питомнике Аль-Шамс» и частном питомнике в 0,2 км к югу от «Питомника Аль-Амерей» в г. Аль-Дибба; они вообще новые для флоры Фуджейры и ОАЭ. *Stellaria media* – обнаружен как сорняк в небольшом саду в Аль-Диббе и на «Пятничном рынке Мазафи», редко встречается в ОАЭ (ранее указывался для оазисов Аль-Айна) и является новым для Фуджейры.

This research is part of the project "Flora of Fujairah, United Arab Emirates", under a cooperation agreement between the Office of the Crown Prince of Fujairah and the Komarov Botanical Institute of the Russian Academy of Sciences, St. Petersburg (Byalt, Korshunov, 2018, 2021a, b, 2022a–c; Byalt et al., 2020a–c; Korshunov, Byalt, 2022). During field investigations in 2017–2022, the authors have documented information on the distribution of new alien plant species in the territory of the Emirate of Fujairah, United Arab Emirates (UAE). The article presents new records found there.

Material and methods

During various botanical surveys in the UAE in 2017–2022, the specimens and/or photos of *Stellaria apetala* Ucria (Caryophyllaceae), *Acalypha lanceolata* Willd. (Euphorbiaceae), *Boerhavia erecta* L. (Nyctaginaceae), *Oxalis dillenii* Jacq. (Oxalidaceae) were collected by the authors in several localities in the territory of the Emirate of Fujairah (UAE) (Fig. 1). Data on plant populations and habitats were also gathered during the expeditions. The following flora compendia and identification guides were used to identify specimens and determine their taxonomic status: local Floras and field guides for UAE (Western, 1989; Jongbloed et al., 2000, 2003; Karim, Fawzi, 2007) and Floras for neighbouring countries (Batanouny, 1981; Collenette, 1985, 1999; Daoud, Al-Rawi, 1985; Phillips, 1988; Cornes C., Cornes M., 1989; Migahid, 1989, 1996; Ghazanfar, 1992, 2003, 2007; Shuaib, 1995; Miller, Cope, 1996; Wood, 1997; Chaudhary, 1999, 2001; Omar, 2001; Jongbloed et al., 2003; Miller, Morris, 2004; Norton et al., 2009; Abdullah, Al-Dosari, 2022; etc.), websites "Flora of Qatar", 2013–2016 (https://www.floraofqatar.com/indexf.htm), "UAE Flora" (https://www.uaeflora.ae; Alyammahi et al., 2023), Norton et al. (2009) and "Global Biodiversity Information Facility" (GBIF. URL: https://www.gbif.org) were used to identify determine.

The alien plant status was determined by the following criteria (Egorov et al., 2016; Baranova et al., 2018): 1) an indication in the literature that the species has been introduced into the study area or a larger region encompassing the study area; 2) the species occurred only or mainly in ruderal and/or weedy habitats; 3) the species occurred in isolation from its main natural geographic range. The status of the alien species was determined to be casual, naturalized, or invasive, using the approach developed by Pyšek et al. (2004) and which is quite widely used in Western Europe (Galasso et al., 2018). However, because our observations were made only once, the alien species status that we give might not be correct.

Specimens were deposited in the following herbaria (acronyms according to Thiers, 2021): (LE), and Wadi Wuraya National Park (FSH, not acronym).

A Garmin GPS 72H was used for the geographic coordinates of the collecting sites. All coordinates use the WGS84 standard.

The locations of the study sites Emirate of Fujairah: Al Dibba town, environs of Masafi, wadi Siji, 3.1 km East from Wadi Siji Old Dam, villages Qidfa and Al Bidya.

Abbreviations used: United Arab Emirates – UAE, spp. – species, fl. – with flowers, fr. – with fruits, veg. – in a vegetative state, juv. – young, underdeveloped. LE – Herbarium of BIN RAS, FSH [not yet acronym] – Fujairah Scientific Herbarium (Byalt et al., 2020d). The labels are in English as in the original. The numbers in square brackets indicate the place of our research, recorded by GPS [point 776] and others. They are given on the labels for the convenience of working with the herbarium.

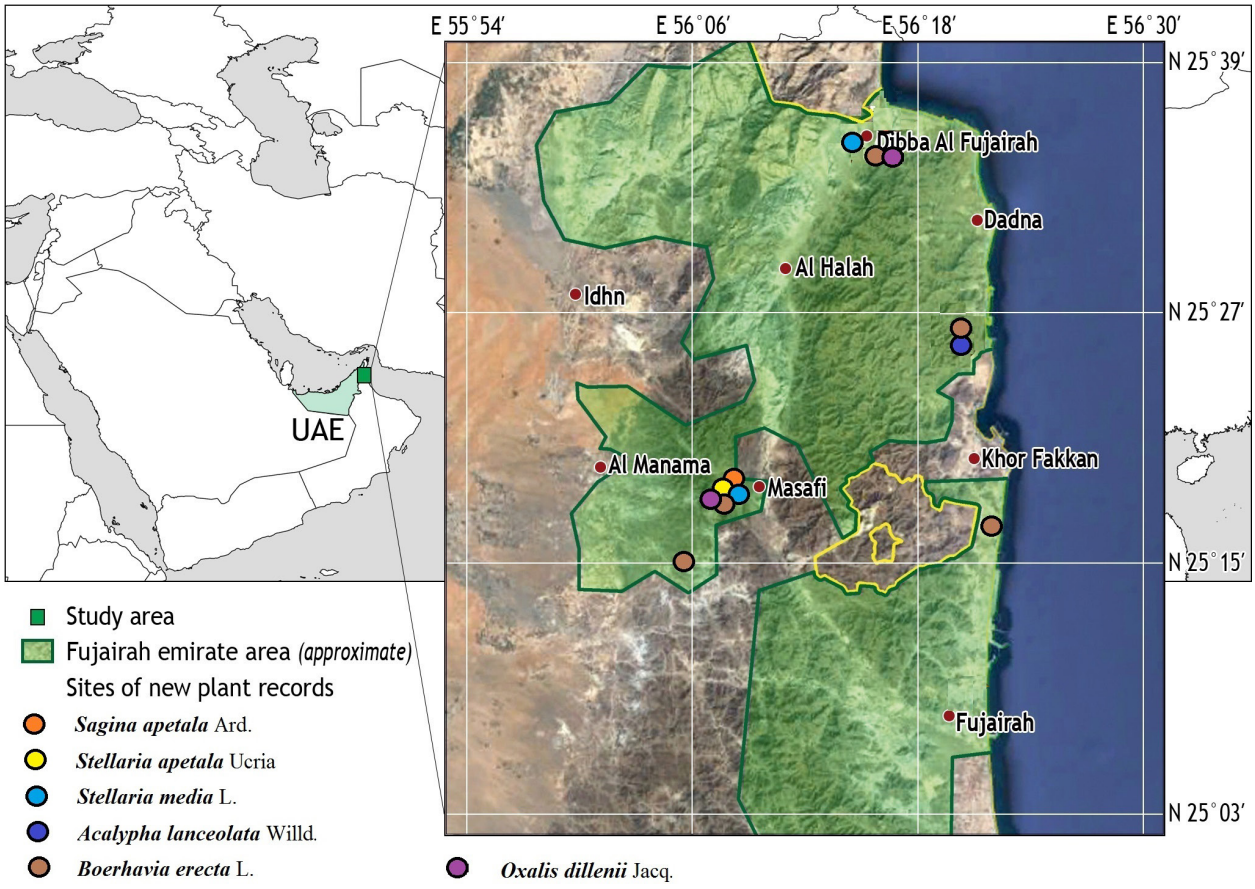

Fig. 1. Map of the distribution of new alien plants in Emirate of Fujairah (based on map of Google Earth): *Sagina apetala* Ard., *Stellaria apetala* Ucria, *Stellaria media* L., *Acalypha lanceolata* Willd., *Boerhavia erecta* L., *Oxalis dillenii* Jacq.

Sagina apetala Ard.: "UAE, Fujairah Emirate, Masafi friday market, E88 Al Dhaid – Masafi road, 4 km to Masafi. 25°17'47.12"N, 56°7'26.88"E, elevation 380 m: weed in plant market and plant nursery, on wet sand on pathside, a few exemplars. 23 III 2020. Fl., fr. V. V. Byalt, M. V. Korshunov 996" (LE). – Therophyte/Annual. European-Southwestern Asian-African. Xenophyte, ephemerophyte, euneophyte. Propagation by seeds, autochorus, anthropochorus. Weed. New species and genus for flora of Arabia (Figs 1, 2).

The native range of this species is Europe to N. Pakistan, Macaronesia, N. Africa to Ethiopia. It grows primarily in the temperate biomes (POWO, 2024). It is recorded as introduced in several countries, including South African Republic and Indonesia (*Sagina apetala*, 2024). Invasive species in India (Sankaran et al., 2021), Australia (Randall et al., 2022), USA (Kraus et al., 2020) et al.

Sagina apetala differs from the closely related annual and perennial species of genus *Sagina* in the following features (see Table 1).

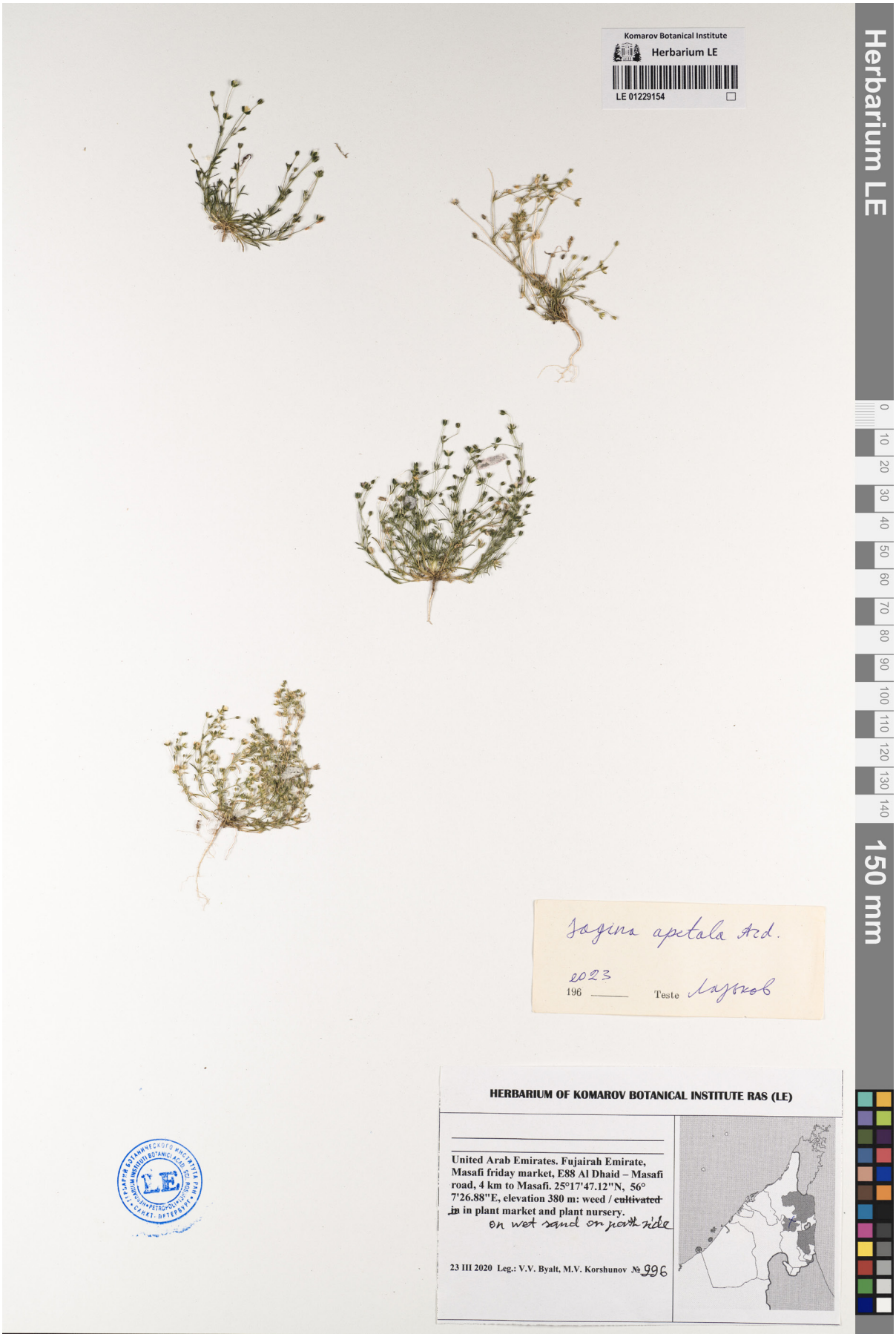

Fig. 2. Herbarium specimen of *Sagina apetala* Ard. from environs of Masafi kept in LE (LE 01229154, scan by L. Orlova).

Table 1

Comparative features of *Sagina apetala* Ard. and closely related species of the genus *Sagina*

Species	Life form	Flowers	Capsules	Leaves
Sagina saginoides (L.) H. Karst.	Perennial	Flowers 5-merous	Capsule splitting by 5 valves. Capsules longer than sepals	Leaf blade bases glabrous
Sagina apetala Ard.	Annual	Flowers 4-merous	Capsule splitting by 4 valves. Capsules equaling to sepals	Leaf blade bases distinctly ciliate, especially of distal cauline leaves
Sagina decumbens (Elliott) Torr. et A. Gray	Annual	Flowers 5-merous (rarely 4-merous)	Capsule splitting by 5 (rarely 4) valves. Capsules longer than sepals	Leaf blade bases never ciliate

Stellaria apetala Ucria (*S. pallida* (Dumort.) P. Fourn.): "UAE, Fujairah Emirate, Masafi friday market, E88 Al Dhaid – Masafi road, 4 km to Masafi. 25°17'47.12"N, 56°7'26.88"E, elevation 380 m: weed in plant market and plant nursery, in pots and between pots on wet sand, in shade. 23 III 2020. Fl. V. V. Byalt, M. V. Korshunov. 976 bis" [mixed with *S. media* on sheet] (LE). – Terophyte/Annual. Eurasian and North African element. Xenophyte, colonophyte, neophyte. Propagation by seeds, autochorus, antropochorous. Weed. Rare alien species in UAE, new to Fujairah (Figs 1, 3).

The native range of this species is Europe to N. China and Arabian Peninsula, Canary Islands, N. Africa (Davis, 1967; Meikle, 1977; Rechinger et al., 1988; Chater, Hetwood, 1993; Boulos, 1999; Wu et al., 2001; Nooteboom, 2002; Lazkov, 2012; Ackerfield, 2015; Danin, Fragman-Sapir, 2019; Dobignard, Chatelain, 2011; etc.). It grows primarily in the temperate biomes (POWO, 2024).

Introduced in more than 10 countries (POWO, 2024), naturalized and invasive in Australia, South Africa, Zambia, Argentina, Mexico, Japan (Exell, Wild, 1961; Germishuizen, Meyer, 2003; Iwatsuki et al., 2006; Zuloaga et al., 2008; Rebman et al., 2016; Zalba et al., 2021; De Salas et al., 2022). In Arabia this is weed in Kuwait, Oman, Qatar, Saudi Arabia, and Yemen (Miller, Cope, 1996; Wood, 1997; Collenette, 1999; Checklist, 2011–2024; Al-Khulaidi, 2013). It is not clear whether this species is native or alien to the indicated countries, possibly an archeophyte and associated with ancient agriculture in the oases. As for the United Arab Emirates and Fujairah, we have no doubts about its alien origin, since we met it once in a clearly anthropogenic habitat in a plant nursery in the city of Masafi and in a small number of individuals (together with *S. media* L.). This species has not previously been reported for the UAE in the main literature (see Western, 1989; Miller, Cope, 1996; Jongbloed et al., 2000, 2003; Karim, Fawzi, 2007), therefore, it is a new alien species for Fujairah and the UAE in general. Not a potentially invasive species due to high substrate moisture requirements.

Stellaria apetala differs from the closely related annual and perennial species of genus *Stellaria* in the following features (see Table 2).

Table 2

Comparative features of closely related species to *Stellaria apetala* Ucria

Species	Stem	Sterile shoots	Capsules	Habit	Seeds
Stellaria apetala Ucria	The stems, herbaceous, terete and glabrous, with a single line of hairs down one side, which alternates at the nodes	Sterile shoots absent	Capsules equaling to slightly longer than sepals	Annual	seeds 6–8, pale brown, ovoid to suborbicular, slightly compressed, 0.5–0.8 mm in diam., with a ring of small, blunt tubercles around the rim
Stellaria decumbens Edgew.	Stem woody at base, hairy all around	Sterile shoots with leaf fascicles	Capsule shorter than sepals	Perennial	Seeds 2–8, smooth
Stellaria media L.	Stems herbaceous, hairy on one side only	Sterile shoots absent	Capsule exceeding sepals	Annual	Seeds numerous, red-brown, ovoid to suborbicular, slightly compressed, 1–1.2 mm in diam., with notable semiglobose-tuberculate

Fig. 3. Herbarium specimen of *Stellaria apetala* Ucria and *S. media* L. collected in Masafi Friday market, kept in LE (LE 01229139, scan by D. Melnikov).

The taxonomic status of *Stellaria apetala* (Dumort.) Piré has been confused. James Dandy (1958) and A. R. Clapham, T. G. Tutin and E. F. Warburg (Clapham et al., 1962) adopted the name *Stellaria pallida* (Dandy, 1958; Clapham et al., 1962), but while Clapham et al. treated *S. apetala* Ucria as a synonym, Dandy considered it to be a synonym of *S. media* L., as also did A. O. Chater and V. H. Heywood (1964). F. H. Whitehead and R. P. Sinha (1967) concluded that *S. apetala* Ucria could be regarded as synonyms of *S. pallida* (Dumort.) Piré. *Stellaria pallida* is now considered as a junior synonym of *Stellaria apetala* (POWO, 2024).

Stellaria media L.: "UAE, Fujairah Emirate, Masafi friday market, E88 Al Dhaid – Masafi road, 4 km to Masafi. 25°17'47.12"N, 56°7'26.88"E, elevation 380 m: weed in plant market and plant nursery, in pots and between pots on wet sand, in shade. 23 III 2020. Fl. V. V. Byalt, M. V. Korshunov. 976" [mixed with *S. apetala* on sheet] (LE); "UAE, Fujairah Emirate, Al Dibba town, Garden on the road corner, 0.15 km North-East from Ministry of Community Development. 25°35'25.46"N, 56°15'32.36"E, elevation 19 m [point 773]: weed in small garden with irrigation near villas gate, between decorative plants. 6 V 2020. Fl., fr. V. V. Byalt, M. V. Korshunov. 2703" (LE). – Terophyte/Annual. Eurasian element. Xenophyte, colonophyte, neophyte. Propagation by seeds, autochorus, antropochorous. Weed. (Fig. 1, 3).

The native range of this species is temperate Eurasia, N. and N.E. Tropical Africa (Dobignard, Chatelain, 2011; Darbyshire et al., 2015; POWO, 2024). It is an annual or biennial and grows primarily in the temperate biome. It is used as animal food, a poison and a medicine, and for food (it is sometimes grown as a salad crop or for poultry consumption) (POWO, 2024).

Recorded as introduced in 61 countries or islands (*Stellaria media*, 2022) and naturalized throughout the world, where it is a weed of waste ground, farmland and gardens. It is invasive in such countries as Australia, New Zealand, South Africa, Zambia, USA, Argentina, Mexico, Japan, etc. (Exell, Wild, 1961; Webb et al., 1988; Germishuizen, Meyer, 2003; Iwatsuki et al., 2006; Zuloaga et al., 2008; Rebman et al., 2016; Foxcroft et al., 2020; Kraus et al., 2020; Randall et al., 2022). In Arabia it is natural in western parts of Saudi Arabia, Yemen, and Kuwait (Ghazanfar, 1992, 2003; Miller, Cope, 1996; Wood, 1997; Collenette, 1999; Abdullah, Al-Dosari, 2022).

In UAE it was recorded by Jongbloed et al. (2003) as weed plant in Al Ain oasis (Abu Dabi emirate). As for the United Arab Emirates and Fujairah, we have no doubts about its alien origin, since we met it in a clearly anthropogenic habitats in a plant nursery in the city of Mazafi and in a small number of individuals (together with *S. media* L.) and as weed in small garden with irrigation near villas gate at Al Dibba town. Rare alien species in UAE, new for Fujairah. It is not a potentially invasive species due to high substrate moisture requirements.

Stellaria media differs from the closely related annual species of the genus *Stellaria* in the following features (see Table 3).

Table 3

Comparative features of closely related species to *Acalypha lanceolata* L.

Species	Inflorescens	Branchlets	Bracts	Leaf blades
A. indica L.	Inflorescences all axillary, pedunculate, androgynous, spicate, up to 10 cm long, with female bracts 3–9, less than 5 mm	Branchlets adpressed pubescent when young	Bracts of the female flowers ovate-cordate, crenulate	Leaf-blade ovate, rhombic-ovate or ovate-lanceolate, 2–6(–9) × 1–5 cm, acute or subacute, cuneate, crenate-serrate
A. lanceolata Willd.	Inflorescences axillary, bisexual, pubescent; peduncle short, 1–3 together, 1–2.5 cm, with female bracts 3–9, less than 5 mm	Branchlets pubescent and sparsely hirsute when young	Female bracts fan-shaped, denticulate	Leaf blade rhombic-ovate or oblong-ovate, 4–8 × 2–4 cm, in base cuneate or broadly cuneate, margin crenate, apex acuminate; basal veins 5
A. ciliata Forssk.	Inflorescences axillary, sessile, androgynous, spicate, up to 2 cm long, with female bracts up to 12 mm	Branchlets sparingly puberulous, sometimes also slightly pilose	Bracts of the female flowers transversely ovate, laciniate-fimbriate or fringed	Leaf-blade elliptic-ovate, 3–8 × 1.5–4 cm, acutely or subacutely caudate-acuminate, cuneate or rounded, crenate-serrate

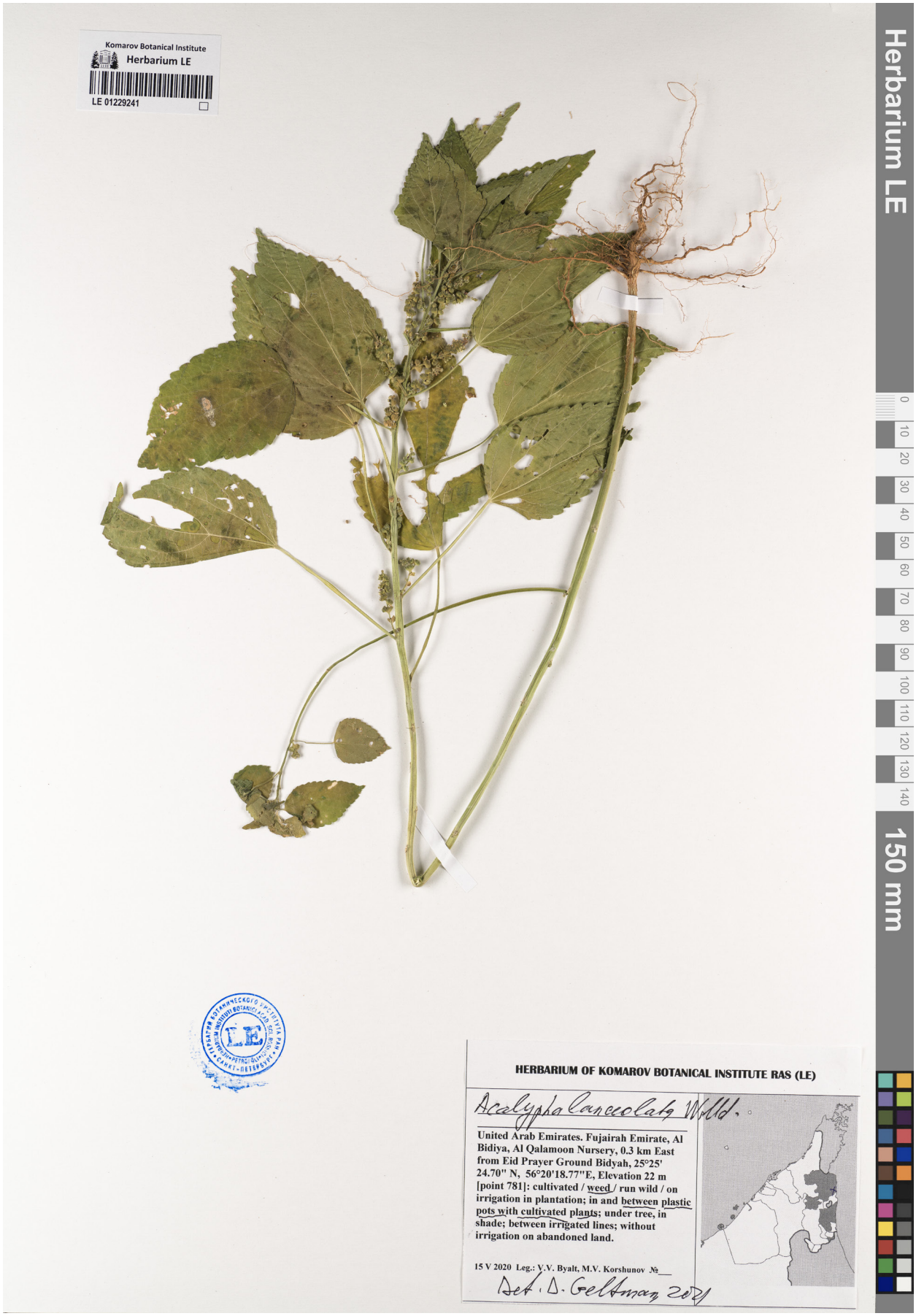

Fig. 4. Herbarium specimen of *Acalypha lanceolata* Willd. from Al Qalamoon Nursery in Village Al Bidya, kept in LE (LE 01229241, scan by D. Melnikov).

Acalypha lanceolata Willd. (Euphorbiaceae): "UAE, Fujairah Emirate, Al Bidiya, Al Qalamoon Nursery, 0.3 km East from Eid Prayer Ground Bidyah, 25°25'24.70"N, 56°20'18.77"E, Elevation 22 m [point 781]: weed between plastic pots with cultivated plants. 15 V 2020. Fl., fr. V. V. Byalt, M. V. Korshunov. s. n." (LE; FSH). – Terophyte/Annual. African-South Asian-Australian tropical. Xenophyte, colonophyte (hemiepecophyte), neophyte. Propagation by seeds, autochorus, antropochorous. Weed-ruderal. New alien species in Fujairah and UAE (Figs 1, 4).

The native range of this species is Tropical Africa to Pacific. It grows primarily in the wet tropical biome (Govaerts, 1995; Govaerts et al., 2000; Sagun et al., 2010; POWO, 2024).

Recorded as introduced in 12 countries (GBIF, 2024). Invasive in India (Balakrishnan, Chakrabarty, 2007; Sankaran et al., 2021), there are no localities in Arabia in the GBIF (*Acalypha lanceolata*, 2024). Study of the pertinent literature revealed that these species has also not been reported from the UAE so far (Western, 1993; Jongbloed, 2000, 2003). Found several specimens in the plant nursery in Al Qalamoon Nursery in village Al Bidya between plastic pots with cultivated plants. New alien species for Fujairah and UAE.

Acalypha lanceolata differs from the closely related annual species of genus *Acalypha* in the following features (see Table 3).

Note. Thus, 10 species and 2 varieties of the genus *Acalypha* have currently been identified on the Arabian Peninsula: **Acalypha chamaedrifolia* (Lam.) Müll. Arg. (*A. hotteana* Urb., *A. reptans* Sw.) cultivated in UAE, *Acalypha ciliata* Forssk. – natural in Saudi Arabia, Yemen, *Acalypha crenata* A. Rich. – natural in Yemen, *Acalypha fruticosa* var. *fruticosa* Forssk. – natural in Saudi Arabia and Yemen, *Acalypha fruticosa* var. *villosa* Hutch. – natural in Saudi Arabia, **Acalypha hispida* Burm. f. – cultivated in Saudi Arabia, *Acalypha indica* L. – natural in Oman, Saudi Arabia, Yemen and alien in UAE, *Acalypha lanceolata* Willd. (syn. *A. glomerata* Hutch.) – natural in Saudi Arabia and Yemen, alien in UAE, *Acalypha racemosa* Wall ex Bail. (syn. *A. paniculata* Miq.) – natural in Saudi Arabia, Yemen, **Acalypha stricta* Poepp. (*Acalypha variegata* Rusby) cultivated in Qatar and alien in UAE, **Acalypha wilckensisna* Muell. Arg. cultivated in Qatar, Saudi Arabia and alien in UAE.

Boerhavia erecta L. (Nyctaginaceae): "United Arab Emirates. Emirate of Fujaira, village Qidfa, 25°17'40.91"N, 56°21'28.51"E [point 343]: roadside in backstreet. – ОАЭ, Фуджейра, пос. Кидфа, 25°17'40.91"N, 56°21'28.51"E [point 343]: обочина дороги в переулке. 25 XI 2019. Fl. V. V. Byalt, M. V. Korshunov. 1763" (LE); "UAE. Emirate of Fujairah, Al Dhaid-Masafi Road, environs of Masafi, 25°17'47.19"N, 56°07'28.25"E [point 358]: weed in Salman Nursery, among plantings. – ОАЭ, Фуджейра, дорога Аль Даид-Мазафи, окр. Мазафи, 25°17'47.19"N, 56°07'28.25"E [точка 358]: сорняк в питомнике Салмана, среди посадок. 29 XI 2019. Fl. V. V. Byalt, M. V. Korshunov. 1874bis, 1797/608" (LE); "UAE, Fujairah Emirate, Al Siji, wadi Siji, 3.1 km East from Wadi Siji Old Dam, 3.6 km South from Masafi Friday Market Sur (plant market 4.8 km from Masafi by E88 road). 25°15'33.84"N, 56°6'30.33"E, elevation 314 m. [730]: on stone-gravel wadi banks, waste place on slope under garden. 1 IV 2020. Fr. V. V. Byalt, M. V. Korshunov. 1616" (LE); "UAE, Fujairah Emirate, Rul Dadhna, Salama Plant Nursery 0.6 km West from ADNOC Petrol Station on E99 Rugaylat road. 25°31'36.30"N, 56°20'58.46"E, elevation 17 m [point 766]: in plant nursery between pots. 25 IV 2020. Fl. V. V. Byalt, M. V. Korshunov 2444" (LE); "UAE, Fujairah Emirate, Al Dibba town, The Green Nursery Sales Dibba, 0.2 km South from Khalid Hadi Resort Dibba. 25°34'29.81"N, 56°14'16.32"E, elevation 44 m [point 795]: weed on irrigated plantation, between irrigated lines and without irrigation on abandoned land, very common. 8 VI 2020. Fl., fr. V. V. Byalt, M. V. Korshunov. 3463" (LE; FSH); "UAE, Fujairah Emirate, Al Bidiya, 0.4 km to South from Eid Prayer Ground Bidyah, 25°25'13.53"N, 56°20'27.57"E, elevation 18 m [point 801]: on irrigation, weed in and between plastic pots, on sand between irrigated lines in nursery, very common. 22 VI 2020. Fr. V. V. Byalt, M. V. Korshunov. 3747 (8)" (LE; FSH). – Terophyte or hemicryptophyte/annual or perennial. American tropical and subtropical, but also invasive in other regions of the world. Xenophyte, hemiepecophyte, euneophyte. Propagation by seeds, autochorus, zoochore, anthropochorus. Weed-ruderal. New alien species in Fujairah, UAE (Jongbloed et al., 2003) (Figs 1, 5). The native range of this species is tropical and subtropical America (Govaerts, 1996; Hokche et al., 2005; Acevedo-Rodríguez, Strong, 2012; Jørgensen et al., 2013; Bernal et al., 2016; Villaseñor, 2016). It grows primarily in the seasonally dry tropical biome. It is used as animal food and a medicine and for food (POWO, 2024). Recorded as introduced in 13 countries or islands (Hutchinson et al., 1954–1958; Van Steenis, 1960–1972; Whitehouse, 1996; Edwards et al., 2000; *Boerhavia erecta*,

2024), and invasive in India (Pramanick et al., 2018), South Africa, Japan (Iwatsuki et al., 2006; Ikeda et al., 2020), Papua New Guinea (Orapa Pagard, 2020). We managed to find a photo of this plant posted on the Al Jaddaf – Dubai – United Arab Emirates website (https://www.inatu.../photos/178661597). But there are no others for the UAE. There is also a photo-confirmed indication for Qatar by Alexei Sergeev from Texas on his website "Flora of Qatar" (2013–2016) (https://www.floraofqatar.com/indexf.htm#Nyctaginaceae) – "near a pond on Green Circles (center-pivot irrigation) in Irkhaya (Irkaya) Farms in Qatar (May 1, 2015)". We have found this plant in large numbers as a weed in irrigated plantation, between irrigated lines and without irrigation on abandoned land, very common in gardens and plant nurseries in summer and autumn period but not in winter-spring. It was found in various locations in Fujairah, sometimes forming large clumps in empty lots and paths, and appears to be already an invasive species in irrigated areas. Also occasionally found in shady alleys and wastelands completely without watering. New alien species for Fujairah. Requires monitoring as an aggressive invasive species.

Boerhavia erecta differs from the closely related annual species of genus *Boerhavia* in the following features (see Table 4).

Table 4

Comparative features of *Boerhavia erecta* L. and closely related species of the genus *Borhavia* L.

Species	Stems	Flowers	Perianth	Anthocarp	Leaf margins
B. coccinea Mill.	Stems sprawling to ascending, most parts hairy	flowers in axillary umbels or cymes, or in ill-defined terminal panicles with lower branches subtended by well-developed leaves	Perianth limb white, pink, or mauve, rarely purplish red, to 2(–2.5) mm	Anthocarp fusiform, 3–3.5(–4) mm, obviously 5-ribbed, usually glandular hairy	Lack of multicellular hairs along the leaf margins
B. diffusa L.	Stems trailing, ascending to erect, upper parts glabrous	flowers in well-defined leafless terminal panicle	Perianth limb bright purple or purple-red	Anthocarp glandular-hairy, tip ± rounded	Leaf margin with stout, multicellular hairs, at least when young
B. erecta L.	Stems erect or decumbent at base, upper parts glabrous	flowers in well-defined leafless terminal panicle	Perianth limb white, red, or pink	Anthocarp glabrous, tip sharply angular	Leaf margin with unicellular hairs
B. elegans Choisy (*B. rubicunda* Steud. ex Heimerl)	Branches erect, Stem woody, diffuse, puberulous	flowers in well-defined leafless terminal panicle	Perianth campanulate, pink, embedded with raphides	Anthocarp narrow to oblong-clavate, c. 3 mm long, 5-ribbed, puberulous in the furrows	Lack of multicellular hairs along the leaf margins
B. repens L.	Stems prostrate on ground or nearly so, most parts hairy	flowers in axillary umbels or cymes, or in ill-defined terminal panicles with lower branches subtended by well-developed leaves	Perianth limb white, pink, or pale purple, to 1 mm	Anthocarp clavate, 3–3.5 mm, 5-ribbed, sparsely puberulent, sometimes with ± sessile glands	Lack of multicellular hairs along the leaf margins

Oxalis dillenii Jacq. (Oxalidaceae): "UAE, Fujairah Emirate, Masafi friday market, E88 Al Dhaid – Masafi road, 4 km to Masafi. 25°17'47.12"N, 56°7'26.88"E, elevation 380 m: weed in plant market and plant nursery, a few. 23 III 2020. Fl. V. V. Byalt, M. V. Korshunov. 982" (LE); "UAE, Fujairah Emirate, Al Dibba town, Al Shams Nursery, near Dibba Theatre (0.1 km to East). 25°36'9.81"N, 56°16'41.30"E, Elevation 6 m [point 767a]: weed (running wild) in plant market and nursery, in pots and between pots.

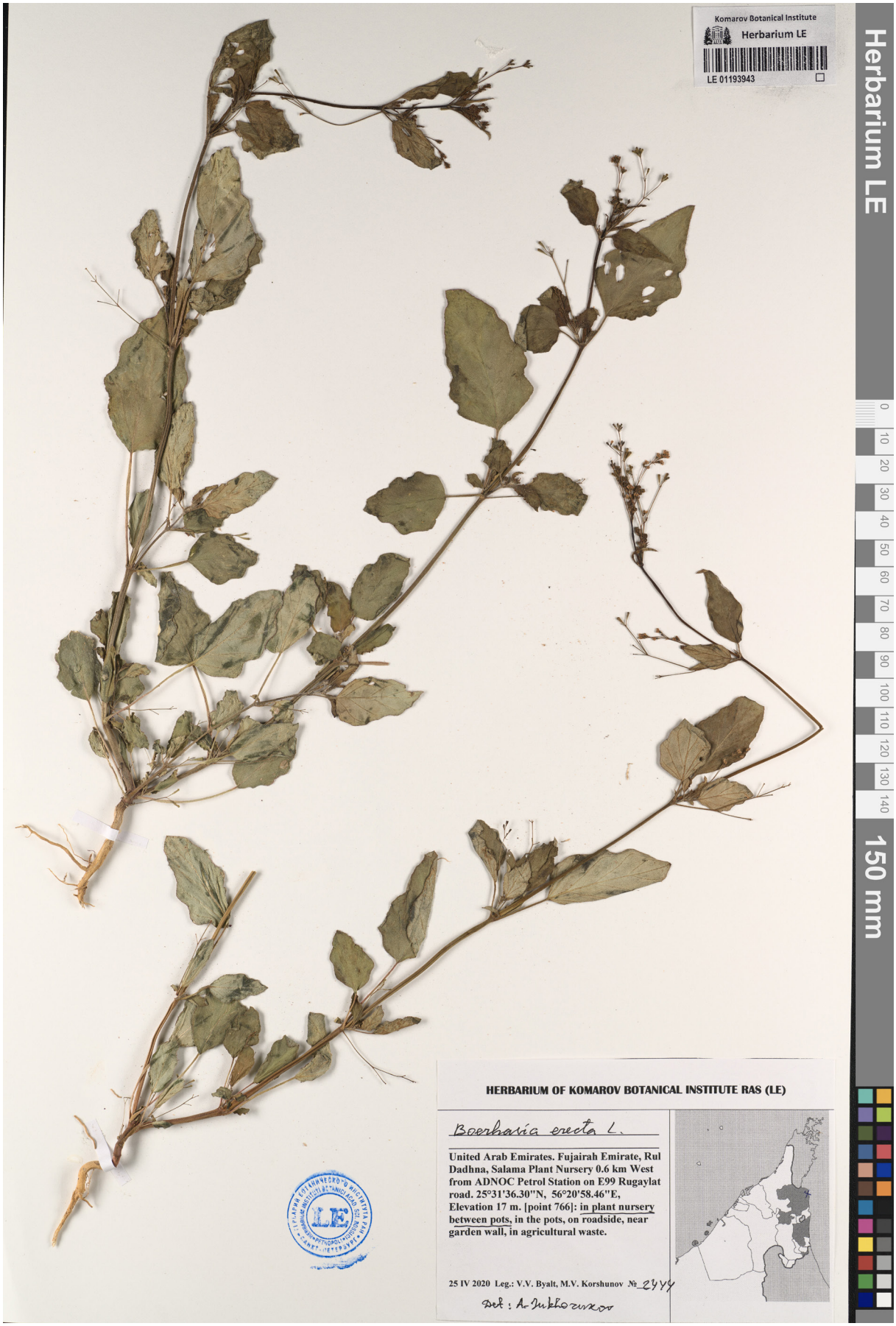

Fig. 5. Herbarium specimen of *Boerhavia erecta* L. from Salama Plant Nursery in Rul Dadhna, kept in LE (LE 0119343, scan by L. Orlova).

28 IV 2020. Fl., fr. V. V. Byalt, M. V. Korshunov. 2553-2" (LE); "UAE, Fujairah Emirate, Al Dibba town, private nurseries, 0.2 km South from Al Amerey Nursery, 25°34'24.07"N, 56°14'6.39"E, Elevation 48 m [point 776]: weed in plastic pots and between pots. 7 V 2020. Fl., fr. V. V. Byalt, M. V. Korshunov. 2744" (LE). – Hemicryptophyte/Caulescent perennial. North American temperate. Xenophyte, colonophyte, euneophyte. Propagation by seeds, autochorus, balistochorus, anthropochorus. Weed. Alien adventive species in Fujairah, UAE. The native range of this species is Central and E. Canada to E. Mexico. It grows primarily in the temperate biomes (Eiten, 1963; Nesom, 2009a, b, 2016; Nesom et al., 2014; Villaseñor, 2016; POWO, 2024). Recorded as introduced in 24 countries or islands (Ebel, 2008; *Oxalis dillenii*, 2024), but no points in Arabia in GBIF (2024). Study of the pertinent literature revealed that the species has also not been reported from the UAE so far (Western, 1993; Jongbloed, 2000, 2003; Karim, Fawzi, 2007; etc.).

Oxalis dillenii was found as weed in "Masafi Friday market" in environs of Masafi town, as rare weed in "Al Shams Nursery" and private nursery in 0.2 km South from "Al Amerey Nursery" at Al Dibba town. It occurs occasionally as an admixture with *O. corniculata* L. and, apparently, is seen in herbarium collections, although it is well distinguished by its life form (see table 5), since it is a stemless perennial (*O. corniculata* forms long creeping but not rooting shoots). It is rarely found in Fujairah under irrigation and is not yet a potentially invasive species. New alien species for Fujairah, UAE and Arabia in general.

Oxalis dillenii differs from the closely related species of genus *Oxalis* in the following features (see Table 5).

Table 5

Comparative features of *Oxalis dillenii* Jacq. and closely related species of the genus *Oxalis* L.

Species	Life form	Plants habit	Stipules	Flowers	Pedicels
O. corniculata L.	Perennials	Plants prostrate or decumbent, root at nodes, without septate hairs on vegetative parts; stolons absent	Stipules well developed	Flowers in an umbellate inflorescence or solitary	Fruiting pedicels deflexed to horizontal
O. dillenii Jacq.	Perennials	Plants caespitose, caulesaent, not root at nodes, with strigillose cauline vestiture on vegetative parts; stolons absent	Stipules reduced	Flowers in an umbellate inflorescence	Fruiting pedicels deflexed to horizontal
O. stricta L.	Annuals or short-lived perennials	Plants erect to decumbent, with septate hairs on vegetative parts; stolons present	Stipules rudimentary	Flowers in a cymose inflorescence	Fruiting pedicels erect

Conclusions

In the flora of the UAE, several taxa have been introduced during development of gardens, road planting and through imported plants and soil in plant nurseries. As our new research has shown, it is now similar for Fujairah. However, alien plants are introduced here exclusively in anthropogenic habitats, disturbed habitats, plant nurseries, private gardens, on wastelands, irrigated lawns, near garden fences with water inflow and along roadsides. The processes of their naturalization in transformed habitats have not yet been completed. With the development of roads, several aliens are found in the mountains along roadsides. In Fujairah, plant nurseries appear to be an important source of introduction of new alien species. These introductions have occurred in the last 20–25 years, as evidenced by the absence of inclusion of these species in the floras of the UAE (Jongbloed et al., 2000, 2003; Karim, Fawzi, 2007).

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REFERENCES / ЛИТЕРАТУРА

Abdullah M. T., Al-Dosari M. E. 2022. *Vegetation of the state of Kuwait*. IUCN, Gland, Switzerland and Environmental Public Authority, Kuwait, State of Kuwait. 258 pp.

Acalypha lanceolata Willd. [2024]. In: *GBIF Secretariat (2023). GBIF Backbone Taxonomy*. Checklist dataset https://doi.org/10.15468/39omei accessed via GBIF.org on 2024-10-10. URL: https://www.gbif.org/species/3056367

Acevedo-Rodríguez P., Strong M. T. 2012. Catalogue of seed plants of the West Indies. *Smithsonian Contributions to Botany* 98: 1–1192.

Ackerfield J. 2015. *Flora of Colorado*. Fort Worth, Texas: BRIT Press. 818 pp.

Al-Khulaidi A. W. 2013. *Flora of Yemen*. The sustainable natural resource management project (SNRMP II) EPA and UNDP. Republic of Yemen. 179 pp.

Alyammahi N. A. S. A., Ridouane F. L., Almoalla A. A., Al Dhanhani A. S. S. J., Gorashi A., Mirza S. B. 2023. Exploration of the native plants from the biodiversity of United Arab Emirates for conservation and reintroduction efforts: collection, verification, design, and implementation of UAE Flora Database. *International Journal of Plant Biology* 14: 493–502. DOI: 10.3390/ijpb14020038

Balakrishnan N. P., Chakrabarty T. 2007. *The family Euphorbiaceae in India. A synopsis of its profile, taxonomy and bibliography.* Dehra Dun: Bishen Singh Mahendra Pal Singh. 500 pp.

Baranova O. G., Shcherbakov A. V., Senator S. A., Panasenko N. N., Sagalaev V. A., Saksonov S. V. 2018. The main terms and concepts used in the study of alien and synanthropic flora. *Phytodiversity of Eastern Europe* 12, 4: 4–22. [In Russian] (***Баранова О. Г., Щербаков А. В., Сенатор С. А., Панасенко Н. Н., Сагалаев В. А., Саксонов С. В.*** Основные термины и понятия, используемые при изучении чужеродной и синантропной флоры // Фиторазнообразие Восточной Европы, 2018. Т. 12, № 4. С. 4–22). DOI: 10.24411/2072-8816-2018-10031

Batanouny K. H. 1981. *Ecology and flora of Qatar*. Oxford: Alden Press Ltd., on behalf of SARC, University of Qatar. 245 pp.

Bernal R., Gradstein R. S., Celis M. (eds.). 2016. *Catálogo de plantas y líquenes de Colombia. Vols. 1–2*. Bogotá: Libro impreso. 3068 pp.

Boerhavia erecta L. [2024]. In: *GBIF Secretariat (2023). GBIF Backbone Taxonomy*. Checklist dataset https://doi.org/10.15468/39omei accessed via GBIF.org on 2024-10-10. URL: https://www.gbif.org/species/3086281

Boulos L. 1999. *Flora of Egypt*. Vol. 1. Cairo: Al Hadara Publishing. 419 pp.

Byalt V. V., Korshunov M. V. 2018. Adventive and invasive plant species in the flora of the United Arab Emirates. In: *Aktualnyye voprosy biogeografii* [*Actual Issues of Biogeography*: Proceedings of International conference 9–12 October 2018. St. Petersburg, Russia]. St. Peterburg: St. Petersburg State University pub. house. Pp. 73–76. [In Russian] (***Бялт В. В., Коршунов М. В.*** Адвентивные и инвазивные виды растений во флоре Объединенных Арабских Эмиратов // Актуальные вопросы биогеографии: Материалы Междунар. конф. (г. Санкт-Петербург, Россия, 9–12 октября 2018 г.). СПб.: изд-во Санкт-Петербургского гос. ун-та, 2018. С. 73–76).

Byalt V. V., Korshunov M. V. 2020a. A new record of the fern *Actiniopteris semiflabellata* Pic. Serm. (Pteridaceae) in the United Arab Emirates. *Skvortsovia* 4, 2: 41–46.

Byalt V. V., Korshunov M. V. 2020b. New alien species of flowering plants to the flora of the Arabian Peninsula. *Novosti Sist. Vyssh. Rast.* 51: 118–124. [In English with Russian abstract] (***Бялт В. В., Коршунов М. В.*** Новые чуже-

родные виды цветковых растений для флоры Аравийского полуострова // Новости сист. высш. раст., 2020. Т. 51. С. 118–124).

Byalt V. V., Korshunov M. V. 2020c. New woody ergasiophygophytes of the flora of Fujairah Emirate (UAE). *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* [*Bull. Moscow Soc. Natur. Biol. Ser.*] 125, 6: 56–62.

Byalt V. V., Korshunov M. V. 2020d. Preliminary list of cultivated plants in the Fujairah Emirate (UAE). *Vestnik of Orenburg State Pedagogical University. Electronic Scientific Journal* 4(36): 29–116. [In Russian] (***Бялт В. В., Коршунов М. В.*** Предварительный список культурных растений эмирата Фуджейра (Объединенные Арабские Эмираты) // Вестник Оренбургского государственного педагогического университета, 2020. № 4(36). С. 29–116). DOI: 10.32516/2303-9922.2020.36.3

Byalt V. V., Korshunov M. V. 2021a. New records for the flora of Fujairah Emirate (United Arab Emirates). *Turczaninowia* 24, 1: 98–107. DOI: 10.14258/turczaninowia.24.1.12

Byalt V. V., Korshunov M. V. 2021b. New records of alien species of the family Urticaceae in the Fujairah Emirate (UAE). *Turczaninowia* 24, 1: 108–116. DOI: 10.14258/turczaninowia.24.1.13

Byalt V. V., Korshunov M. V. 2022a. Flora of Fujairah Emirate (UAE): new herbaceous and woody species of ergasiofigophytes in Emirate. Part 4. *Vavilovia* 5, 3: 1–25. DOI: 10.30901/2658-3860-2022-3-o1

Byalt V. V., Korshunov M. V. 2022b. Review of cultivated and wild species of the family Convolvulaceae s. l. in the Emirate of Fujairah (UAE). *Vestnik of Orenburg State Pedagogical University. Electronic Scientific Journal* 4(44): 1–76. [In Russian] (***Бялт В. В., Коршунов М. В.*** Обзор культивируемых и дикорастущих видов семейства Convolvulaceae s. l. в эмирате Фуджейра (Объединенные Арабские Эмираты) // Вестник Оренбургского государственного педагогического университета. Электронный научный журнал, 2022. № 4 (44). С. 1–76). DOI: 10.32516/2303-9922.2022.44.1

Byalt V. V., Korshunov M. V. 2022c. Several records of alien species new to the flora of the United Arab Emirates (UAE). *Turczaninowia* 25, 4: 169–179. DOI: 10.14258/turczaninowia.25.4.19

Byalt V. V., Korshunov M. V., Korshunov V. M. 2020. The Fujairah Scientific Herbarium – a new Herbarium in the United Arab Emirates. *Skvortsovia* 6, 3: 7–29.

Chater A. O., Heywood V. H. 1964. *Stellaria* L. In: *Flora Europaea. Vol. 1*. Cambridge University Press. Pp. 134–135.

Chaudhary S. A. 1999. *Flora of the Kingdom of Saudi Arabia illustrated. Vol. 1.* Riyadh, Saudi Arabia: National Agriculture and Water Research Centre. 691 pp.

Chaudhary S. A. 2001. *Flora of the Kingdom of Saudi Arabia illustrated. Vol. 2 (2).* Riyadh, Saudi Arabia: NationalAgriculture and Water Research Center. 432 pp.

Checklist – Flora Saudi Arabia. 2011–2024. In: *Plant Diversity in Saudi Arabia*. URL: http://plantdiversityofsaudiarabia.info/Biodiversity-Saudi-Arabia/Flora/Checklist/Cheklist.

Clapham A. R., Tutin T. G., Warburg E. F. 1962. *Flora of the British Isles.* 2nd ed. Cambridge; New York: Cambridge University Press. 1269 pp.

Collenette Sh. 1985. *An illustrated guide to the flowers of Saudi Arabia*. London: Scorpion publishing Ltd. 514 pp.

Collenette Sh. 1999. *Wildflowers of Saudi Arabia.* Riyadh: National Commission for Wildlife Conservation and Development (NCWCD), Kingdom of Saudi Arabia. 799 pp.

Cornes C. D., Cornes M. D. 1989. *The Wild Flowering plants of Bahrain.* London: IMMEL Publishing. 272 pp.

Dandy J. E. 1958. *List of British Vascular Plants*. London: British Museum. xvi, 176 pp.

Danin A., Fragman-Sapir O. 2019. *Flora of Israel Online*. URL: http://flora.org.il/en/plants/ (Accessed 10 October 2024).

Daoud H. S., Al-Rawi A. 1985. *Flora of Kuwait. Vol. 1: Dicotyledoneae*. London: KPI Limited & University of Kuwait. 284 pp.

Darbyshire I., Kordofani M., Farag I., Candiga R., Pickering H. 2015. *The Plants of Sudan and South Sudan.* Kew publishing, Royal Botanic Gardens, Kew. 400 pp.

Davis P. H. (ed.). 1967. *Flora of Turkey and the East Aegean Islands. Vol. 2.* Edinburgh University Press, Edinburgh. 581 pp.

De Salas M. F., Baker M. L. 2022. *A census of the vascular plants of Tasmania, including Macquarie Island*: 1-161. Hobart: Tasmanian Herbarium, Tasmanian Museum and Art Gallery. https://flora.tmag.tas.gov.au/resources/census (Accessed 10 October 2024).

Dobignard A., Chatelain C. 2011. *Index synonymique de la flore d'Afrique du nord.* Vol. 3. Genève: Éditions des conservatoire et jardin botaniques. 449 pp.

Ebel A. *L.* 2008. New and rare species of flowering plants to the flora of Altai mountain country. *Turczaninowia* 11, 4: 77–85. [In Russian] (***Эбель А. Л.*** Новые и редкие виды цветковых растений для флоры Алтайской горной страны // Turczaninowia, 2008. Т. 11, № 4. С. 77–85).

Edwards S., Tadesse M., Demissew S., Hedberg I. (eds.). 2000. *Flora of Ethiopia and Eritrea.* Vol. 2, pt. 1. Uppsala: The National Herbarium, Addis Ababa University, Ethiopia & The Department of Systematic Botany, Upps. 532 pp.

Egorov A., Byalt V., Pismarkina E. 2016. Alien plant species in the north of western Siberia. In: *UArctic Congress 2016*. St. Petersburg, Russia. P. 105.

Eiten G. 1963. Taxonomy and regional variation of *Oxalis* section *Corniculatae*. I. Introduction, keys and synopsis of the species. *Amer. Midl. Naturalist* 69: 257–309

Exell A. W., Wild H. (eds.). 1961. *Flora Zambesiaca*. Vol. 1(2). Kew: Royal Botanic Gardens, Kew. Pp. 337–581.

Flora of Qatar (2013–2016). URL: https://www.floraofqatar.com/indexf.htm (Accessed 10 October 2024).

Foxcroft L., Baard J. A., Bredenkamp N., Pagad S. 2020. *Protected Areas – Global Register of Introduced and Invasive Species – Garden Route National Park, South Africa. Version 1.1.* Invasive Species Specialist Group ISSG. Checklist dataset https://doi.org/10.15468/hy8wnh accessed via GBIF.org (Accessed 10 October 2024).

Galasso G., Conti F., Peruzzi L., Ardenghi N. M. G., Banfi E., Celesti-Grapow L., et al. 2018. An updated checklist of the vascular flora alien to Italy. *Plant Biosystems* 152(3): 556–592.

GBIF [2024]. *Global Biodiversity Information Facility*. URL: https://www.gbif.org/ (Accessed 10 October 2024).

Germishuizen G., Meyer N. L. (eds.). 2003. Plants of Southern Africa: an annotated checklist. *Strelitzia* 14: 1–1231.

Ghazanfar S. A. 1992. An annotated catalogue of the vascular plants of Oman and their vernacular names. In: *Scripta Botanica Belgica*. Vol. 2. Meise, Belgium: National Botanic Garden of Belgium. Pp. 1–152.

Ghazanfar S. A. 2003. *Flora of the Sultanate of Oman*. Vol. 1. Piperaceae – Primulaceae. In: *Scripta Botanica Belgica*. Vol. 25. Meise, Belgium: National Botanic Garden of Belgium. Pp. 1–262.

Ghazanfar S. A. 2007. *Flora of the Sultanate of Oman*. Vol. 2. Crassulaceae – Apiaceae. In: *Scripta Botanica Belgica.* Vol. 36. Meise, Belgium: National Botanic Garden of Belgium. Pp. 1–220.

Ghazanfar S. A. 2015. *Flora of the Sultanate of Oman*. Vol. 3. Loganiaceae – Asteraceae. In: *Scripta Botanica Belgica.* Vol. 55. Meise, Belgium: National Botanic Garden of Belgium. Pp. 1–386.

Ghazanfar S. A., Nasir Y. J. 1986. *Flora of Pakistan.* Vol. 175. Karachi: Department of Botany, University of Karachi. 125 pp.

Govaerts R. 1995. *World Checklist of Seed Plants.* Vol. 1 (pts. 1, 2). Deurne, Belgie: MIM. 483 pp., 529 pp.

Govaerts R. 1996. *World Checklist of Seed Plants.* Vol. 2 (pts. 1, 2). Deurine: Belgie: MIM. 492 pp.

Govaerts R., Frodin D. G., Radcliffe-Smith A. 2000. *World Checklist and Bibliography of Euphorbiaceae (and Pandaceae*). Vols. 1–4. Kew: The Board of Trustees of the Royal Botanic Gardens. 1622 pp.

Hokche O., Berry P. E., Huber O. (eds.). 2008. *Nuevo Catálogo de la Flora Vascular de Venezuela*. Fundación Instituto Botánico de Venezuela. 859 pp.

Hutchinson J., Dalziel J. M., Keay R. W. J. 1954–1958. *Flora of West Tropical Africa*, ed. 2. Vol. 1. London: Crown Agents for oversea government and administations Millbank. 828 pp.

Ikeda T., Iwasaki K., Suzuki T., Wong L. J., Pagad S. 2020. *Global Register of Introduced and Invasive Species – Japan. Version 1.1.* Invasive Species Specialist Group ISSG. Checklist dataset https://doi.org/10.15468/nt2yla accessed via GBIF.org (Accessed 10 October 2024).

Iwatsuki K., Boufford D. E., Ohba **H.** (eds.). 2006. *Flora of Japan*. Vol. IIa. Tokyo: Kodansha Ltd. 550 pp.

Jongbloed M., Feulner G., Böer B., Western A. R. 2003. *The comprehensive guide to the Wild Flowers of the United Arab Emirates*. Abu Dhabi, UAE: E.R.W.D.A. Abu Dhabi. 576 pp.

Jongbloed M., Western R. A., Böer B. 2000. *Annotated check-list of plants in the U.A.E.* Dubai: Zodiac Publishing. 91 pp.

Jørgensen P. M., Nee M. H., Beck S. G. (eds.). 2013. Catálogo de las plantas vasculares de Bolivia. *Monographs in Systematic Botany from the Missouri Botanical Garden* 127: 1–1741.

Karim F. M., Fawzi N. M. 2007. *Flora of the United Arab Emirates.* 2 vols. Al-Ain: United Arab Emirates University Publications. Vol. 1. 444 pp.; Vol. 2. 502 pp.

Korshunov M. V., Byalt V. V. 2022. New records of the five alien species from the flora of United Arab Emirates. *Turczaninowia* 25, 2: 125–136. DOI: 10.14258/turczaninowia.25.2.12

Kraus F., Daniel W., Wong L. J., Pagad S. 2020. *Global Register of Introduced and Invasive Species – United States of America (Contiguous). Version 1.4.* Invasive Species Specialist Group ISSG. Checklist dataset https://doi.org/10.15468/ehzr9f accessed via GBIF.org (Accessed 10 October 2024).

Lazkov G. A. 2012. *Stellaria* L. In: A. L. Takhtajan (ed.). *Konspekt flory Kavkaza* [*Caucasian Flora Conspectus*]. Vol. 3(2). St. Petersburg-Moscow: KMK Scientific Press. Pp. 161–162.

Meikle R. D. 1977. *Flora of Cyprus.* Vol. 1. Kew; The Bentham-Moxon Trust Royal Botanic Gardens. 832 pp.

Migahid A. M. 1989. *Flora of Saudi Arabia.* Ed. 3. Vol. 1–2. Riyadh, Saudi Arabia: University Libraries, King Saud University. 251 pp., 282 pp.

Migahid A. M. 1996. *Flora of Saudi Arabia*, ed. 4. Vol. 1–2. Riyadh: King Saud University Press. 252 pp., 282 pp.

Miller A. G., Cope T. A. 1996. *Flora of the Arabian Peninsula and Socotra.* Vol. 1. Edinburgh: Edinburgh University Press. 586 pp.

Miller A. G., Morris M. 2004. *Ethnoflora of Soqotra Archipelago*. Edinburgh: The Royal Botanic Garden. 759 pp.

Mosti S., Raffaelli M., Tardelli M. 2012. Contributions to the flora of central-southern Dhofar (Sultanate of Oman). *Webbia; Raccolta de Scritti Botanici* 67: 65–91.

Nesom G. L. 2009a. Again: taxonomy of yellow-flowered caulescent *Oxalis* (Oxalidaceae) in eastern North America. *Journal of the Botanical Research Institute of Texas* 3: 727–738.

Nesom G. L. 2009b. Taxonomic notes on acaulescent *Oxalis* (Oxalidaceae) in the United States. *Phytologia* 91: 501–526.

Nesom G. L. 2016. Oxalidaceae. In: *Flora of North America Editorial Committee (2016). Flora of North America North of Mexico.* Vol. 12. New York, Oxford: Oxford University Press. (http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=10644).

Nesom G. L., Spaulding D. D., Horne H. E. 2014. Further observations on the *Oxalis dillenii* group (Oxalidaceae). *Phytoneuron* 12: 1–10.

Nooteboom H. P. (ed.). 2002. *Flora Malesiana. Vol. 16*. Djakarta: Noordhoff-Kolff N.V. 224 pp.

Norton J. A., Abdul Majid S., Allan D. R., Al Safran M., Boer B., Richer R. 2009. *An illustrated checklist of the Flora of Qatar.* Doha: Unesco office in Doha. 95 pp.

Omar S. A. S. 2001. *Vegetation of Kuwait: A comprehensive illustrative guide to the flora and ecology of the desert of Kuwait.* Kuwait: Kuwait Institute for Scientific Research. 159 pp.

Orapa W., Pagad S. 2020. *Global Register of Introduced and Invasive Species – Papua New Guinea. Version 1.2.* Invasive Species Specialist Group ISSG. Checklist dataset https://doi.org/10.15468/rn4el2 accessed via GBIF.org (Accessed 10 October 2024).

Oxalis dillenii Jacq. [2024]. In: *GBIF Secretariat (2023). GBIF Backbone Taxonomy*. Checklist dataset https://doi.org/10.15468/39omei accessed via GBIF.org on 2024-10-10. URL: https://www.gbif.org/species/2891677

Phillips D. C. 1988. *Wild Flowers of Bahrain: a field guide to herbs, shrubs and trees*. Manama, Bahrain: Published privately. 206 pp.

POWO [2024]. *Plants of the World Online.* Kew: Facilitated by the Royal Botanic Gardens. URL: http://www.plantsoftheworldonline.org (Accessed 10 October 2024).

Pramanick D. D., Maiti G. G., Mondal M. S. 2018. Enumeration of the family Nyctaginaceae in India. *Indian Forester* 144: 825-831.

Pyšek P., Richardson D. M., Rejmanek M., Webster G. L., Williamson M., Kirschner J. 2004. Alien plants in checklists and floras: towards better communication between taxonomists and ecologists. *Taxon* 53: 131–143

Randall J., McDonald J., Wong L. J., Pagad S. 2022. *Global Register of Introduced and Invasive Species – Australia. Version 1.9.* Invasive Species Specialist Group ISSG. Checklist dataset https://doi.org/10.15468/3pz20c accessed via GBIF.org (Accessed 10 October 2024).

Rebman J. P., Gibson J., Rich K. 2016. Annotated checklist of the vascular plants of Baja California, Mexico. *Proceedings of the San Diego Society of Natural History* 45: 1–352.

Rechinger K. H., Melzheimer V., Möschl W., Schiman-Czeika H. 1988. *Flora Iranica. Vol. 163. Caryophyllaceae*. Graz: Akademische Druck- u. Verlagsanstalt. 528 pp.

Sagina apetala Ard. [2024]. In: *GBIF Secretariat (2023). GBIF Backbone Taxonomy*. Checklist dataset https://doi.org/10.15468/39omei accessed via GBIF.org on 2024-10-10. URL: https://www.gbif.org/species/8941837

Sagun V. G., Levin G. A., van Welzen P. C. 2010. Revision and phylogeny of *Acalypha* (Euphorbiaceae) in Malesia. *Blumea* 55: 21–60.

Sankaran K. V., Khuroo A. A., Raghavan R., Molur S., Kumar B., Wong L. J., Pagad S. 2021. *Global Register of Introduced and Invasive Species – India. Version 1.5.* Invasive Species Specialist Group ISSG. Checklist dataset https://doi.org/10.15468/uvnf8m accessed via GBIF.org (Accessed 24 January 2023).

Shuaib L. 1995. *Wildflowers of Kuwait.* London: Stacey International. 128 p., color ills., maps.

Simpson A., Sellers E., Pagad S. 2023. *Global Register of Introduced and Invasive Species – United States (Contiguous) (ver.2.0, 2022).* Invasive Species Specialist Group ISSG. Checklist dataset https://doi.org/10.5066/p9kfftod accessed via GBIF.org (Accessed 10 October 2024).

Stellaria media (L.) Vill. [2024]. In: *GBIF Secretariat (2023). GBIF Backbone Taxonomy*. Checklist dataset https://doi.org/10.15468/39omei accessed via GBIF.org on 2024-10-10. URL: https://www.gbif.org/species/5384604

Thiers B. 2021. *Index Herbariorum: A global directory of public herbaria and associated staff.* New York Botanical Garden's Virtual Herbarium. URL: http://sweetgum.nybg.org/ih/ (Accessed 10 October 2024).

Turrill W. B. 1956. *Flora of Tropical East Africa, Caryophyllaceae*. Kew: Royal Botanic Gardens. 38 pp.

Chater A. G., Heywood V. H. 1993. *Flora Europaea*. Ed. 2. Vol. 1. Cambridge: Cambridge University Press. Pp. 161–164.

UAE Flora [2024]. URL: https://www.uaeflora.ae. (Accessed 10 October 2024).

Van Steenis C. G. G. J. (ed.). 1960–1972. *Flora Malesiana*. Vol. 6. Djakarta: Noordhoff-Kolff N.V. 1023 pp.

Villaseñor J. L. 2016. Checklist of the native vascular plants of Mexico. *Revista Mexicana de Biodiversidad* 87: 559–902.

Webb C. J., Sykes W. R., Garnock-Jones P. J. 1988. *Flora of New Zealand. Vol. 4.* Christchurch: Botany division, D.S.I.R. 1365 pp.

Western A. R. 1989. *The flora of the United Arab Emirates: an introduction.* Al Ain: United Arab Emirates University. 188 pp.

Whitehead F. H., Sinha R. P. 1967. Taxonomy and taximetrics of *Stellaria media* (L.) Vill., *S. neglecta* Weihe and *S. pallida* (Dumort.) Pire. *New Phytologist*. Blackwell Publishing 66 (4): 769–784. DOI: 10.1111/j.1469-8137.1967.tb05444.x. JSTOR 2430464

Whitehouse C. 1996. *Nyctaginaceae. Flora of Tropical East Africa*. Kew. 20 pp.

Wood J. R. I. 1997. *A handbook of the Yemen flora*. Kew, UK: Royal Botanic Gardens. 434 pp.

Wu Z., Raven P. H., Hong D. Y. (eds.). 2001. *Flora of China*. Vol. 6. *(Caryophyllaceae through Lardizabalaceae)*. Beijing: Science Press; St. Louis: Missouri Botanical Garden Press. 511 pp.

Zalba S. M., Sanhueza C., Cuevas Y., Wong L. J., Pagad S. 2021. Global Register of Introduced and Invasive Species – Argentina. Version 1.6. Invasive Species Specialist Group ISSG. Checklist dataset https://doi.org/10.15468/qr5pjs accessed via GBIF.org (Accessed 10 October 2024).

Zuloaga F. O., Morrone O., Belgrano M. J., Marticorena C., Marchesi E. (eds.). 2008. Catálogo de las Plantas Vasculares del Cono Sur. *Monographs in Systematic Botany from the Missouri Botanical Garden* 107: 1–3348.