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Records of the fourteen wild and alien species of the family Fabaceae new to the flora of United Arab Emirates (UAE)

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Keywords: Arabian Peninsula, chorology, Fujairah, invasive species, plant geography, Scientific Herbarium of Fujairah.

Summary. The article presents new records for fourteen native and alien species previously unknown or rare from flora of United Arab Emirates (UAE) – *Alysicarpus vaginalis*, *Cajanus cajan*, *Cicer arietinum*, *Clitoria ternatea*, *Crotalaria pallida*, *Desmodium triflorum*, *Lablab purpureus*, *Phaseolus lunatus*, *Pueraria tuberosa*, *Tephrosia subtriflora*, *Trifolium alexandrinum*, *Trifolium pratense*, *Trifolium repens* and *Trifolium resupinatum*. All of them are registered for the first time in the emirate of Fujairah in the northeastern part of the UAE, while *Alysicarpus vaginalis* (collected in the village of Al Bidya and Rul Dadna), *Cajanus cajan* (Al Fujairah city and Al Dibba town), *Cicer arietinum* (in Al Dibba town), *Clitoria ternatea* L. (env. Rul Dadna, Masafi and Al Dibba), *Lablab purpureus* (Al Bidya and Al Dibba) are reported for the first time for the flora of the UAE. *Crotalaria pallida* (in Al Dibba), *Desmodium triflorum* (Al Dibba town) *Pueraria tuberosa* (in Dibba town), *Phaseolus lunatus* (Al Khala settlement), *Trifolium pratense* (Wadi Wuraya) are new species for the Arabian Peninsula as a whole. The remaining species: *Tephrosia subtriflora* (Al Fujairah, Al Dibba and Rul Dadna), *Trifolium alexandrinum* (in environs of vil. Al Wahlah), *Trifolium repens* (Wadi Wuraya), and *Trifolium resupinatum* (in environs of vil. Al Wahlah and in village Bithna), are new wild or alien species for the Fujairah emirate.

Species, synonyms, spatial distribution, habitat preferences, as well as the list of localities are presented. The herbarium materials were transferred to the Herbarium of the Komarov Botanical Institute (LE, St. Petersburg, Russia), the duplicates – to the Herbarium of Altai State University (ALTB, Barnaul, Russia) and the Scientific Herbarium of Fujairah (FSH, Wadi Wuraya national park, Fujairah, United Arab Emirates) (in case they are available).

Находки четырнадцати новых и редких дикорастущих и чужеродных видов из семейства Fabaceae для флоры Объединенных Арабских Эмиратов

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Ключевые слова: Аравийский полуостров, география растений, Научный гербарий Фуджейры, хорология, чужеродные виды, Фуджейра.

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Аннотация. В статье представлены новые находки тринадцати чужеродных и одного аборигенного вида, ранее неизвестных во флоре Объединенных Арабских Эмиратов (ОАЭ): *Alysicarpus vaginalis* – сорное в питомниках в пос. Аль-Бидия и в местах орошения в пос. Рул-Дадна, *Cajanus cajan* – одичавшее возле станции ADNOC в окр. г. Аль-Фуджейра, район Сакамкам, сорное у тенистой стены в г. Аль-Дибба и самосев вокруг горшков в питомнике в пос. Аль-Бидья, *Cicer arietinum* – на пустыре возле жилья работников питомника в Аль-Дибба, *Clitoria ternatea* – на пустыре за жилым домом и заборе сада в пос. Рул-Дадна, одичавшее на пятничном рынке Масафи и в питомнике растений в Аль-Дибба, *Crotalaria pallida* – сорное или одичавшее растение на месте заброшенного питомника в Аль-Дибба, *Desmodium triflorum* – сорное в питомнике растений в Аль-Дибба, *Lablab purpureus* – на садовой ограде в окр. пос. Аль-Бидья и одичавшие на стене у виллы в Аль-Дибба, *Phaseolus lunatus* – сорная лиана на садовой изгороди в пос. Аль-Хала, *Pueraria tuberosa* – как сорняк в питомнике растений в г. Аль-Дибба, *Tephrosia subtriflora* – дикое в реликтовом лесу возле дворца шейха в окр. г. Эль-Фуджейры, на пустыре в Аль-Дибба и в гравийно-песчаной вади возле садов в пос. Рул-Дадна, *Trifolium alexandrinum* – сорное в частично заброшенном саду в вади Форт Аль-Хило в окр. пос. Аль-Вахла, *Trifolium pratense* и *Trifolium repens* – на орошаемое место под деревьями в Национальном парке Вади-Вурайя (Центр биоразмножения аравийских таров), *Trifolium resupinatum* – сорное в частично заброшенном саду в вади Форт Аль-Хило, окр. пос. Аль-Вахла и сорное в орошаемом месте в д. Битна. Все они зарегистрированы впервые в эмирате Фуджейра в северо-восточной части ОАЭ, при этом *Alysicarpus vaginalis*, *Cajanus cajan*, *Cicer arietinum*, *Lablab purpureus* впервые отмечены для флоры ОАЭ. *Crotalaria pallida*, *Pueraria tuberosa*, *Phaseolus lunatus*, *Trifolium pratense* – новые адвентивные виды для Аравийского полуострова в целом. Остальные виды – *Tephrosia subtriflora, Trifolium alexandrinum, Trifolium repens* и *T. resupinatum* – являются новыми аборигенными или чужеродными видами для эмирата Фуджейра.

Приведены названия, синонимы, распространение, местообитания и таксономия видов, а также перечень местонахождений. Гербарные материалы хранятся в Гербарии Ботанического института им. В. Л. Комарова (LE, г. Санкт-Петербург, Россия), дубликаты переданы в Гербарий Алтайского государственного университета (ALTB, г. Барнаул, Россия) и Научный гербарий Фуджейры (FSH, Национальный парк Вади-Вурайя, г. Фуджейра, Объединенные Арабские Эмираты).

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 et al., 2020a–c; Byalt, Korshunov, 2021a, b, 2022a-d; etc.). During field research in 2017 to 2022, the authors have collected data on the distribution of new records (wild and escapes from cultivation) for the Emirate of Fujairah (United Arab Emirates – UAE).

The article presents new records for *Alysicarpus vaginalis* (L.) A. DC., *Cajanus cajan* (L.) Huth, *Cicer arietinum* L., *Clitoria ternatea* L., *Crotalaria pallida* Ait., *Desmodium triflorum* (L.) DC., *Lablab purpureus* (L.) Sweet, *Phaseolus lunatus* L., *Pueraria tuberosa* (Roxb. ex Willd.) DC., *Tephrosia subtriflora* Hochst. ex Baker, *Trifolium alexandrinum* L., *Trifolium pratense* L., *Trifolium repens* L., and *Trifolium resupinatum* L.

The discovered species were found far away from the main range and in the conditions of various disturbed habitats – in plant nurseries, private gardens, on wastelands, abandoned and new lawns, in irrigation circles and along roadsides, as weeds in plant nurseries, which is why we classify them as alien. In Fujairah, an important source of introduction of new alien species seems to be their use in cultivation or introduction with planting material in plant nurseries and animal feed on farms.

Material and methods

During various botanical surveys in the UAE in 2017–2022 years, the specimens of *Alysicarpus vaginalis*, *Cajanus cajan*, *Cicer arietinum*, *Crotalaria pallida*, *Lablab purpureus*, *Phaseolus lunatus*, *Pueraria tuberosa*, *Tephrosia subtriflora*, *Trifolium alexandrinum*, *T. pratense*, *T. repens*, *T. resupinatum* (Fabaceae) were collected by the authors in several localities in the territory of the Emirate of Fujairah (UAE) (Fig. 1–3). 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., 2003; Karim, Fawzi, 2007) and Floras for neighbouring countries (Collenette, 1985, 1999; Daoud, Al-Rawi, 1985; Cornes C. D., Cornes M. D., 1989; Ghazanfar, 1992; Migahid, 1996; Miller, Cope, 1996; Wood, 1997; Jongbloed et al., 2003; Norton et al., 2009; Al-Khulaidi, 2013; etc.). The status of the alien species was determined using mentioned above sources as well as Norton et al. (2009), "Plants of the World Online" (POWO, 2024. URL: http://

www.plantsoftheworldonline.org) and "Global Biodiversity Information Facility" (GBIF, 2024. URL: https://www.gbif.org).

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 some 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, 2024): Herbarium of the Komarov Botanical Institute of the Russian Academy of Sciences, St. Petersburg (LE) (here the main collections of 2017–2019 years are stored), Herbarium of South-Siberian Botanical Garden of Altai State University, Barnaul (ALTB) (some of the duplicates), and Wadi Wurayah National park (FSH, not acronym yet) in UAE (here the main collections of 2020 year are stored).

A Garmin GPS 72H was used for the geographic coordinates of the collecting sites. The identification and corroboration were performed with different relevant floras. The location of the plants was determined using a GPS receiver or Google Maps. All coordinates use the WGS84 standard.

The locations of the study sites in Emirate of Fujairah: Al Dibba town, environs of Al Fujairah city, Masafi town, village Al Bidya, village Al Khala, village Bithna, Al Wahlah fort, Wadi Wuraya, Rul Dadna, and village Al Bidya.

Accepted abbreviations: United Arab Emirates – UAE, spp. – species, fl. – with flowers, fr. – with fruits, veg. – in a vegetative state, juv. – young, underdeveloped. 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.

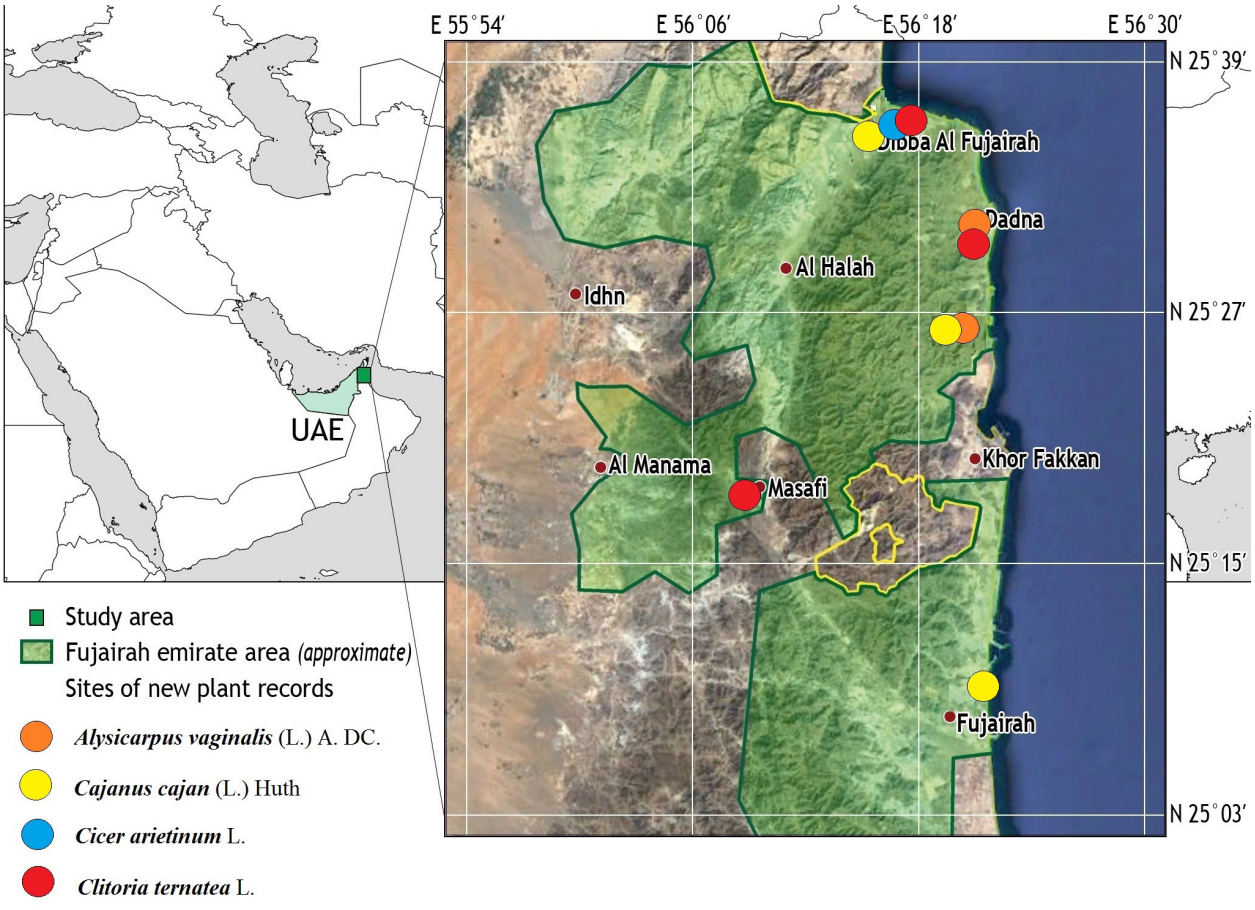

Fig. 1. Map of the distribution of new alien plants in Emirate of Fujairah (based on map of Google Earth): *Alysicarpus vaginalis*, *Cajanus cajan*, *Cicer arietinum*, *Clitoria ternatea*.

The article also presents life forms according to the system of C. Raunkiaer (1905, 1934, 1937) / and according to the simplified system of I. G. Serebryakov (1964).

Results and discussion

New alien species for Fujairah from the Fabaceae (Leguminosae). Below are the records of 1 wild and 13 alien species of vascular plants new to Fujairah, made on the territory of the emirate.

Alysicarpus vaginalis (L.) A. DC.: "UAE. Emirate of Fujairah, env. of village Al Bidya, private garden and nursery of Dr. Ali near Hajar mountains, 25.436911°N, 56.333818°E / 25°26'12.8796"N, 56°20'1.7448"E, weed in nursery. – ОАЭ, Фуджейра, посёлок Бидия, сад директора нац. парка Али возле гор Хаджар, 25.436911°N, 56.333818°E: сорняк в питомнике. 11 XII 2017. [Fl., fr.] V. V. Byalt. № 692" (LE 01194478) (var. *stocksii* Baker); "UAE. Fujairah Emirate, Rul Dhadna, villas and accommodations north from Mina road, on corner with E99 Rugaylat road. 25°31'16.29"N, 56°21'19.69"E, 12 m [point 755]: in irrigation spot under date palm cultivated near villas, on roadside. 17 IV 2020. [Fl., fr.] V. V. Byalt, M. V. Korshunov 2188" (LE 01194253; ALTB; FSH; MW); "UAE, Fujairah emirate, Al Bidya, Al Qalamoon Nursery, 0.3 km East from Eid Prayer Ground Bidyah, 25°25'24.70"N, 56°20'18.77"E, 22 m [point 781]: weed in and between plastic pots with cultivated plants. 15 V 2020. [Veg.] V. V. Byalt, M. V. Korshunov 3010" (FSH); "UAE, Fujairah emirate, Al Bidya, Desert Oasis Nursery Bidyah, 0.7 km West from Bidiyah Association for Culture and Folklore. 25°26'9.06"N, 56°20'17.72"E, 14 m [point 794]: weed in plastic pot and between pots, 4 VI 2020. [Fr.] V. V. Byalt, M. V. Korshunov 3429" (FSH). – Hemicriptophyte/Perennial. Distribution by seeds (Fig. 1, 5B).

The native range of this species is Africa, Tropical and Subtropical Asia to New Guinea and N. Australia (Peyre de Fabregues, Lebrun, 1976; Boulvert, 1977; Rechinger, Podlech, 1984; Lock, 1989; Govaerts, 1995; Verdcourt, 2000; Du Puy et al., 2002; Kumar, Sane, 2003; Figueiredo, Smith, 2008; Mostaph, Uddin, 2013; Pickering, Darbyshire, 2015; POWO, 2024; etc.).

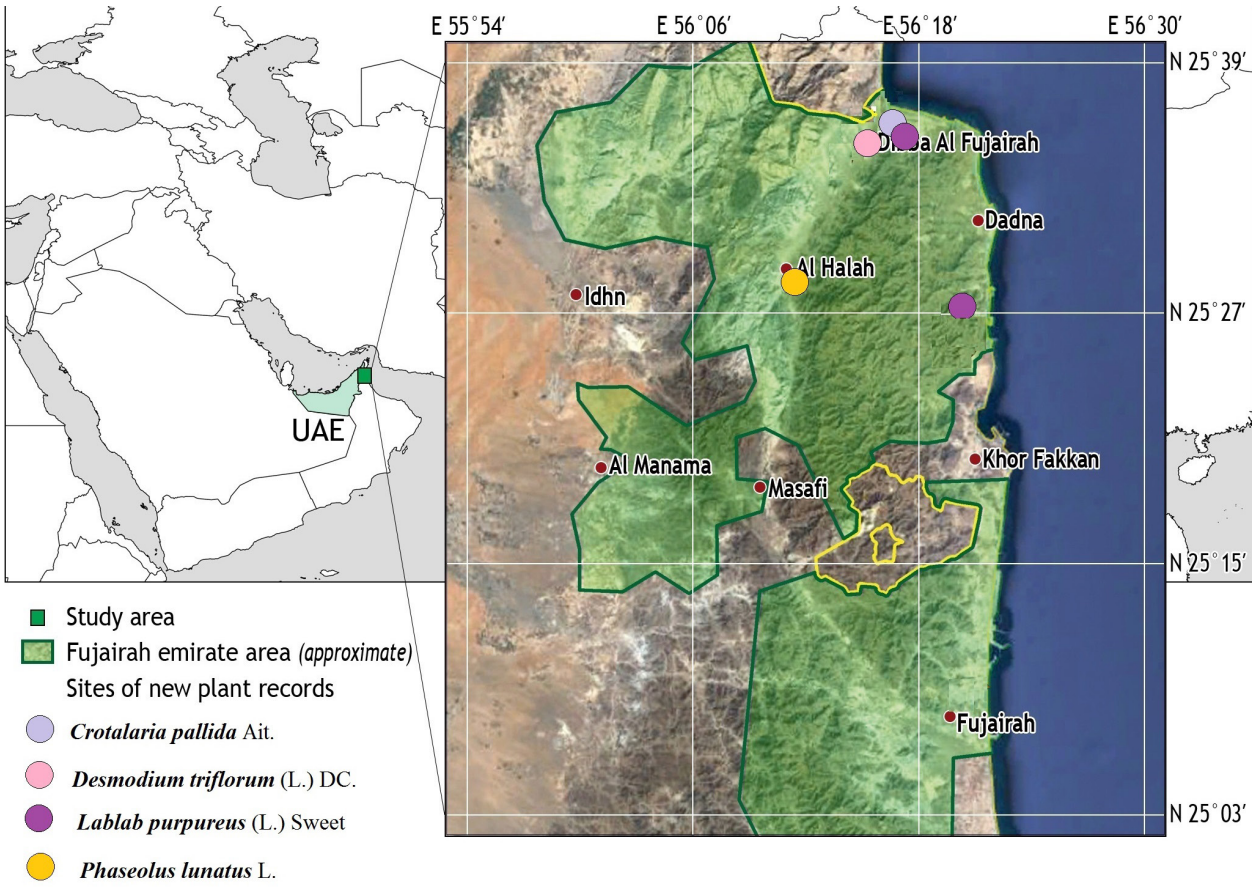

Fig. 2. Map of the distribution of new alien plants in Emirate of Fujairah (based on map of Google Earth): *Crotalaria pallida*, *Desmodium triflorum*, *Lablab purpureus*, *Phaseolus lunatus*.

Alysicarpus vaginalis is recorded as an introduced alien species for 45 countries of the world (Ohashi, 2001; Wu, Raven, 2010; *Alysicarpus vaginalis*, 2024; POWO, 2024; etc.). It is included in the lists of invasive species in the USA (Kraus et al., 2020; Simpson et al., 2023), Mexico (González Martínez, 2020), Australia (Lepschi, Monro, 2014; Randall et al., 2022) and others. For Arabia, this species is indicated for Oman – there are several points in the south of the country on the GBIF website (*Alysicarpus vaginalis*, 2024), although we could not find references in the literature (Ghazanfar, 1992, 2007; Pickering, Patzelt, 2008; Feulner, 2011; etc.).

Another species of the genus, *Alysicarpus heterophyllus* (Baker) Jafir et Ali, was previously reported from Al Ain (Emirate of Abu Dhabi) by F. Karim and N. M. Fawzi (Jongbloed et al., 2000; Karim, Fawzi, 2007). It has trifoliate rather than simple leaves of *A. vaginalis*, brick red flowers rather than pinkish red, and hairy rather than glabrous pods. M. Jongbloed et al. (2000) recorded for UAE one more species of *Alysicarpus* – *A. glumaceus* (Vahl) DC. which is annual with pods distinctly constricted between the articles and ridged transversally. Thus, three alien species of the genus *Alysicarpus* occur in the UAE.

Cajanus cajan (L.) Huth: "UAE, Fujairah emirate, Al Fujairah city, Sakamkam area, Rugaylat road, ADNOC petrol station, opposite to EPPCO petrol station. 25°9'41.39"N, 56°21'1.39"E, 6 m [point 715]: cultivated and running wild on gravel-sand near wall and in small irrigated garden near station. 19 III 2020 [Fl., fr.] V. V. Byalt, M. V. Korshunov 753" (LE 01194455; FSH); "UAE, Fujairah emirate, Al Dibba town, side streets between villas, 0.7 km South-South-West from Street Number 35, or North-North-East from Federal Electricity & Water Authority, 25°36'0.77"N, 56°15'50.95"E, 12 m [point 770]: weed near shady wall, in plantation. 2 V 2020. [Fl., fr., veg.] V. Byalt, M. Korshunov 2611" (FSH); "UAE, Fujairah emirate, Al Bidya, Desert Oasis Nursery Bidyah, 0.7 km West from Bidiyah Association for Culture and Folklore. 25°26'9.06"N, 56°20'17.72"E, 14 m [point 794]: cultivated in plastic pot. 4 VI 2020. [Fl.] V. V. Byalt, M. V. Korshunov 3454" (FSH). – Chamaephyte/shrub. Distributed by seeds (Fig. 1, 4B, C).

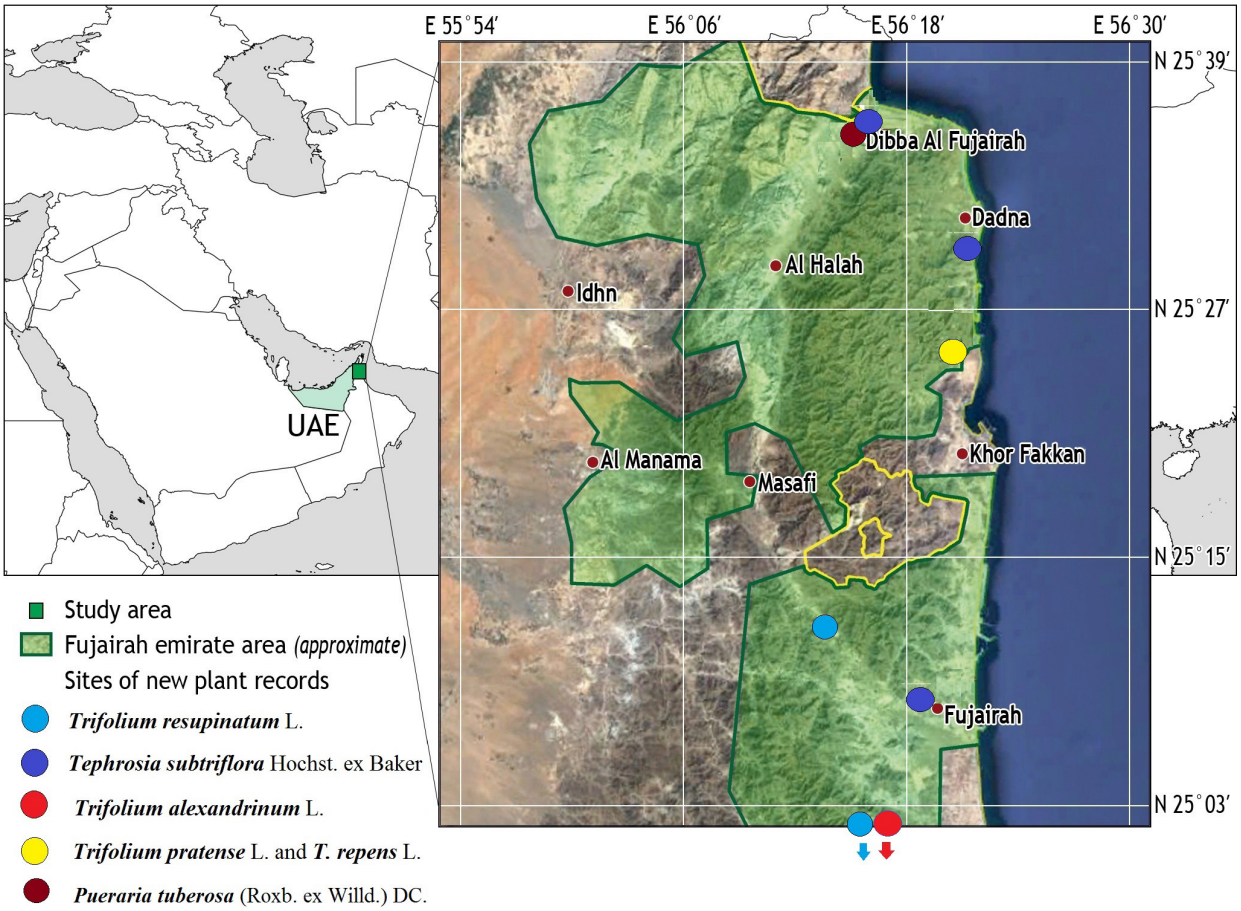

Fig. 3. Map of the distribution of new alien plants in Emirate of Fujairah (based on map of Google Earth): *Pueraria tuberosa*, *Tephrosia subtriflora*, *Trifolium alexandrinum*, *Trifolium pratense*, *Trifolium repens*, *Trifolium resupinatum*.

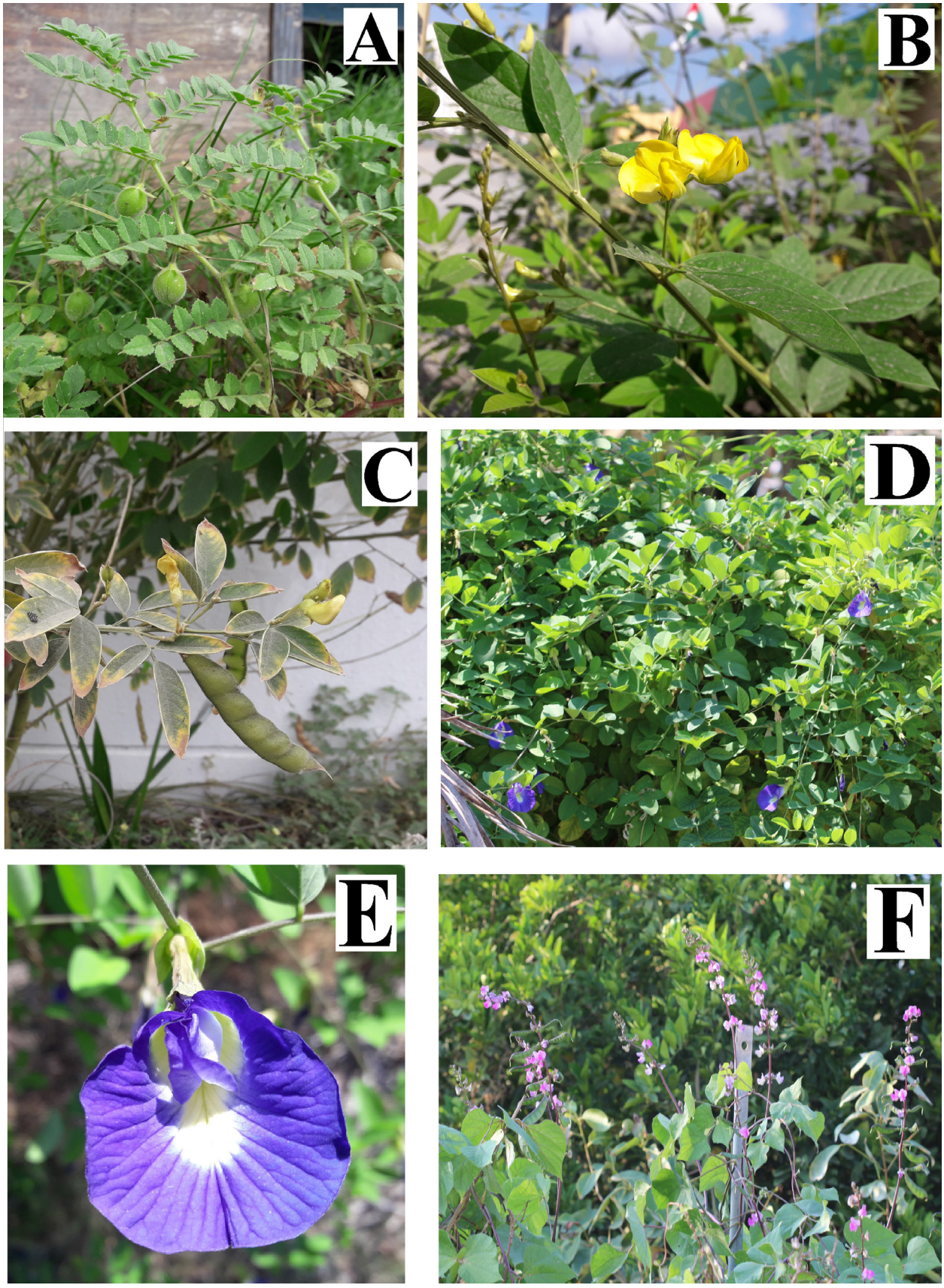

Fig. 4. New alien plants in Emirate of Fujairah: A – *Cicer arietinum* grows as weed in private plant nursery in Dibba (photo by V. Byalt); B, C – *Cajanus cajan* grows as weed near station ADNOC in environs of Al Fujairah city, Sakamkam area (photo by M. Korshunov and V. Byalt); D, E – *Clitoria ternatea* – runs wild near garden fence in village Rul Dadna (photo by V. Byalt), F – *Lablab purpureus* – on garden fence near farm in village Al Bidya (photo by M. Korshunov).

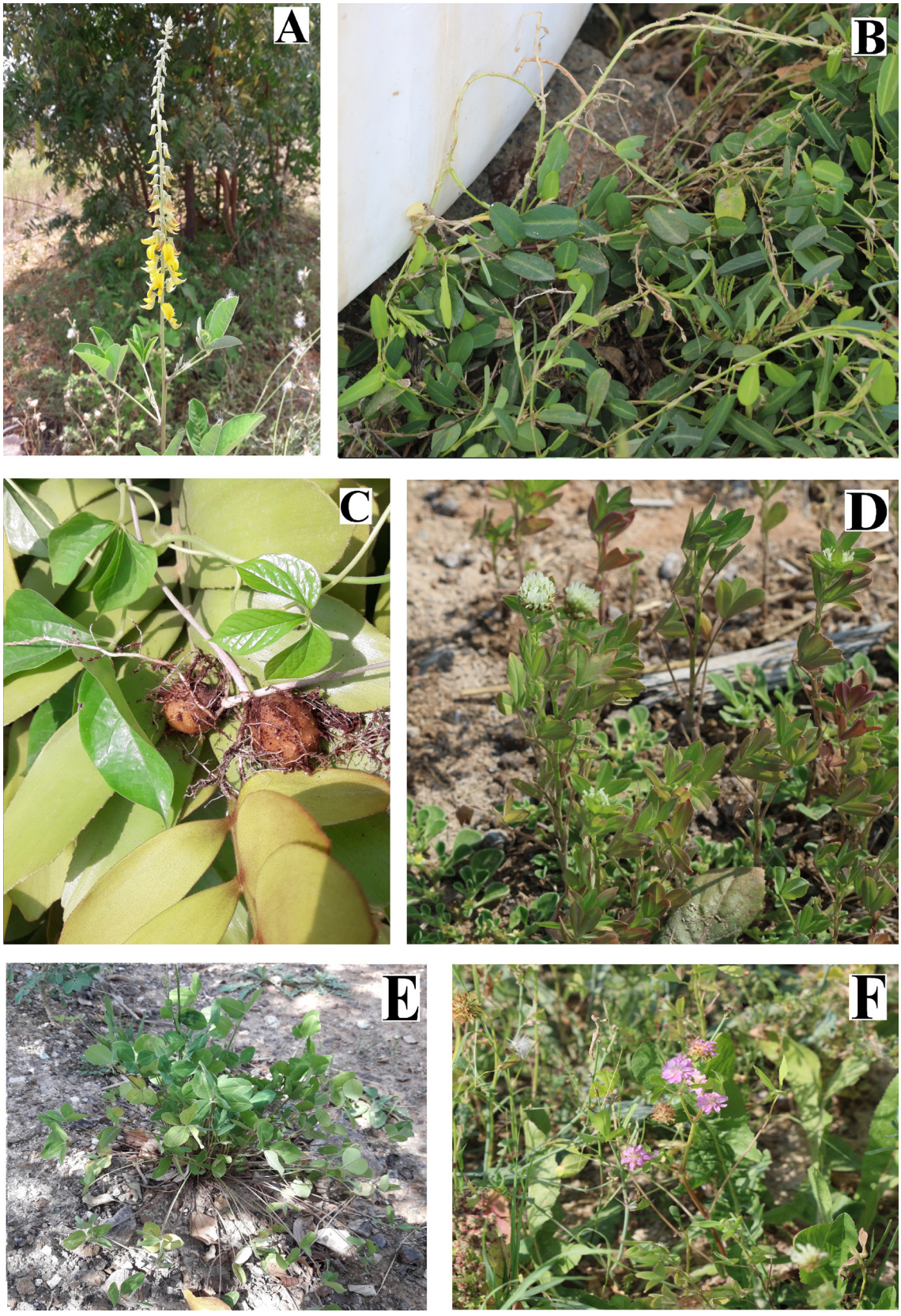

Fig. 5. New alien plants in Emirate of Fujairah: A – *Crotalaria pallida* grows wild in abandoned private plant nursery in Dibba (photo by V. Byalt); B – *Alysicarpus vaginalis* grows as weed in irrigation spot under date palm in village Rul Dadna; C – *Pueraria tuberosa* – grows as weed in plant nursery at Al Dibba town (photo by M. Korshunov); D – *Trifolium alexandrinum* grows as weed in partly abandoned orchard in wadi Al Hilo Fort (environs of village Al Wahlah) (photo by V. Byalt); E – *Trifolium pratense* – grows under trees in Wadi Wurayah Centre of Bioreproduction of Arabian tars (photo by V. Byalt), F – *Trifolium resupinatum* grows as weed in partly abandoned orchard in wadi Al Hilo Fort (environs of village Al Wahlah) (photo by V. Byalt).

A cultivar taxon that is not known in the wild but is of Indian origin (Lock, 1989; Kumar, Sane, 2003; Lock, Ford, 2004; POWO, 2024; etc.). This species has been introduced into 43 countries of the world (*Cajanus cajan*…, 2022) and is included in the lists of invasive species in some countries, for example, in the USA (Kraus et al., 2020; Simpson et al., 2023), South Africa (Robinson et al., 2022), Australia (Lepschi, Monro, 2014; Randall et al., 2023), Yemen (Al-Khulaidi, 2013), etc. Occasionally cultivated in Fujairah (for example, grown for sale in a nursery in Al Bidya) and sometimes self-sows around plant pots and runs wild on irrigation around plantings – in the years. Al Dibba and Fujairah. We observed especially massive self-sowing and undergrowth near the ADNOC gas station in the suburbs of Fujairah. Potentially invasive species in irrigated lands. A new alien species for Fujairah and the UAE.

Cicer arietinum L.: "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, 6 m [point 767a]: weed near home of workers in plant market and nursery. 28 IV 2020. [Fr., fl.] V. V. Byalt, M. V. Korshunov 2528" (FSH). – Therophyte/Annual herb. Distributed by seeds (Fig. 1, 4A).

This species (mutton chickpea) is a well-known food plant that has developed in the South-West Asia (Iran and Iraq) (Lock, Ford, 2004; Dobignard, Chatelain, 2012; Zohary, 2012; Kumar, Sane, 2003; POWO, 2024; etc.). Now the species has been introduced in many countries of the world (*Cicer arietinum*…, 2024) and in some of them it is included in the lists of invasive species, for example, in the USA (Kraus et al., 2020), Belgium (Desmet et al., 2020), Great Britain (Roy et al., 2020) and many others. Rarely cultivated in Arabia and in Al Dibba most likely grew from accidentally dropped seeds. Not included in any of the local floras and checklists, except for the flora of Yemen (Wood, 1997; Al-Khulaidi, 2013), where it is listed as cultivated. Study of the pertinent literature revealed that this species has also not been reported from the UAE so far (Western, 1993; Jongbloed et al., 2000, 2003). Found several specimens in the plant nursery in Al Dibba town in a vacant lot near the nursery workers' accommodations. New alien species for Fujairah and UAE.

Clitoria ternatea L.: "UAE, Fujariah Emirate, Rul Dadna, drainage channel, buildings. 25°31'9.23"N, 56°21'19.67"E, 13 m: on a wasteland behind a residential building (near the back wall). 26 III 2020 [Fl., fr.] V. V. Byalt, M. V. Korshunov 1127" (LE 01193805); "UAE, Fujairah emirate, Rul Dadna, 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, 17 m [point 766]: on and near garden wall, cultivated and run wild (seedlings). 25 IV 2020. [Fl., fr.] V. B. Byalt, M. V. Korshunov 2451" (FSH); "UAE, Fujairah emirate, Masafi friday market [Salaman and al. plant nurseries], E88 Al Dhaid – Masafi road, 4 km to Masafi. 25°17'47.12"N, 56° 7'26.88"E, 380 m [point 358a]: run wild on paths between plastic pots, on sand. 2 VI 2020. [Fr.] V. B. Byalt, M. V. Korshunov 3375" (FSH); "UAE, Fujarah Emirate, Al Dibba town, plant nursery "Corniche Nursery", 0.4 km South-West by road from roundabout between Corniche Street 101 and Sambraid Beach road. 25°36'19.87"N, 56°17'0.48"E, 3 m [point 800]: cultivated and run wild in and between plastic pots with cultivated plants. 19 VI 2020. [Fl., veg.] V. V. Byalt, M. V. Korshunov 3722" (FSH); "UAE, Fujairah Emirate, Al Bidya, 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]: cultivated and run wild in and between plastic pots, in shade". 22 VI 2020. [Fr.] V. V. Byalt, M. V. Korshunov № 2744 (2)" (LE 01259692; FSH). – Hemicriptophyte / Perennial climber. Distribution by seed (Fig. 1, 4D, E).

This plant is native to Africa and Tropical Asia, including the Indian subcontinent and South-East Asia (Govaerts, 1999; Du Puy et al., 2002; Brummit et al., 2007; Kumar, Sane, 2003; Dobignard, Chatelain, 2012; POWO, 2023+, etc.), but has also been introduced to South Africa, Australia, and America. As a result, it is now included in the lists of invasive species in the USA (Kraus et al., 2020; Simpson et al., 2023), Australia (Lepschi et al., 2014; Randall et al., 2022), and South Africa (Dobignard, Chatelain, 2012; Kraus et al., 2022), Mexico (González Martínez, 2020), Australia (Randall et al., 2022), India (Sankaran et al., 2021), and many more, in total cultivated in 50 countries of the world (Clitoria ternatea..., 2019). Study of the pertinent literature revealed that this species have not been reported from the UAE so far (Western, 1993; Jongbloed et al., 2000, 2003). In the Fujairah emirate, it is quite often cultivated (Byalt, Korshunov, 2020) and sometimes runs wild, and it begins to run wild even in plant nurseries (in Rul Dadna, Masafi and Al Dibba), where it is grown in pots for sale and usually gives a massive self-sowing on the damp sand around the pots. In addition, we observed him in a wild state at the fence of the garden in the village Rul Dadna and in a weedy place behind a residential building in the same settlement (Fig. 4 D, E). New alien species for

Fujairah and the UAE. Potentially invasive species on irrigation and in wastelands.

Crotalaria pallida Ait. "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, 6 m [point 767]: weed or naturalized plant in wasteland in place of an abandoned garden (or plant nursery). 28 IV 2020. [Veg., fr., fl.] V. V. Byalt, M. V. Korshunov 2468" (FSH, 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, 6 m [point 767a]: weed in plant market and nursery. 28 IV 2020 [Fl., veg.] V. V. Byalt, M. V. Korshunov 2542" (LE). – Hemicryptophyte / Perennial. Distribution by seeds (Fig. 2, 5A).

Originates from Tropical Africa and Asia (Kumar, Sane, 2003; Nkonki et al., 2003; Polhill, 2003; Lock, Ford, 2004; POWO, 2024; etc.). It has been introduced into 33 countries of the world (Jørgensen et al., 2013; Silva Flores, De Azevedo Tozzi, 2018; *Crotalaria pallida*…, 2020; etc.), and in a number of them it is included in the lists of invasive species, for example, in the USA (Kraus et al., 2022; Simpson et al., 2023), Japan (Ikeda et al., 2022), Australia (Lepschi et al., 2014; Randall et al., 2022) and others. Study of the pertinent literature revealed that this species has not been reported from the UAE so far (Western, 1993; Jongbloed et al., 2000, 2003). We found it on abandoned and looks like a wasteland between the gardens and the active nursery. On the sand grows a large number of plants in different stages of development from young juvenile to fertile. In other places of Fujairah, we have not yet met this species. A new alien species for Fujairah, the UAE and Arabia in general.

Desmodium triflorum (L.) DC. (*Grona triflora* (L.) H. Ohashi et K. Ohashi): "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, 48 m [point 776]: weed in plastic pots. 7 V 2020 [Fl., fr.] V. V. Byalt, M. V. Korshunov 2760" (LE). – Hamecryptophyte/ Perennial or small subshrub. Distribution by seeds (Fig. 2).

Pantropical species (tropics of America, Africa and Asia) (Verdcourt, 2000; Téllez et al., 2001; Du Puy et al., 2002; Kumar, Sane, 2003; Lock, Ford, 2004; Miller, Morris, 2004; etc.). Listed as an alien species for 30 countries of the world (*Desmodium triflorum*…, 2020). It is included in the lists of invasive species in the USA (Isely et al., 1998; Kraus et al., 2020), Brazil (Forzza et al., 2016–2020; Ziller et al., 2020), Seychelles (Senterre et al., 2020), etc. Found once in a plant nursery in Al Dibba, where it weeds in plastic pots with cultivated plants. Apparently, it was accidentally brought along with planting material from India or Pakistan. A new species for Fujairah it has not yet been reported for Arabia as a whole (see Daoud, Al-Rawi, 1985; Phillips, 1988; Cornes C. D., Cornes M. D., 1989; Western, 1989; Ghazanfar, 1992; Shuaib, 1995; Migahid, 1996; Wood, 1997; Omar, 2000; Jongbloed et al., 2003; Karim, Fawzi, 2007; Norton et al., 2009; etc.). It is not yet a potentially invasive species due to its rarity and high moisture-loving nature. New alien species for Fujairah, the UAE, and Arabia as a whole.

Lablab purpureus (L.) Sweet: "Fujairah Emirate, Al Bidya, small villas and gardens 0.9 km to West-North-West from Green Cost Nursery Bidiya plant selling. 25°25'59.12"N, 56°19'49.63"E, 38 m [point 778]: on garden fence near farm in wadi. 11 V 2020. [Veg.] V. V. Byalt, M. V. Korshunov 2827" (LE); "UAE, Fujairah Emirate, Al Dibba town, 0.2 km North from ADNOC Service Station, Al Muhallab (885), 25°35'45.41"N, 56°16'36.48"E, 14 m [point 790]: near villa on wall. 23 V 2020. [Fl.] V. V. Byalt, M. V. Korshunov 3211" (LE). – Liana /Annual liana. Ergasiophygophyte (xenophyte), colonophyte, euneophyte. Distribution by seeds, ballistochorous (Fig. 2, 4F).

Native land is India and Tropical Africa but widely cultivated in the tropics (Brummit et al., 2007; Du Puy et al., 2002; Nkonki et al., 2003; Kumar, Sane, 2003; Figueiredo, Smith, 2008; POWO, 2024+). Reported as introduced to 41 countries (Standley, Steyermark, 1946; Townsend, 1974; Lock, 1989; Brako, Zarucchi, 1993; Lock, Heald, 1994; Yakovlev et al., 1996; Lock, Ford, 2004; Wu, Raven, 2010; Garcia-Mendoza, Meave, 2012; Jørgensen et al., 2013; Mostaph, Uddin, 2013; Pickering, Darbyshire, 2015; Forzza et al., 2016–2020; *Lablab purpureus*…, 2024). In some of them, it is included in the lists of invasive species, for example, in the USA (Kraus et al., 2020; Simpson et al., 2023), Japan (Ikeda et al., 2020), India (Sankaran et al., 2021), Australia (Lepschi et al., 2014; Randall et al., 2022), Brazil (Ziller et al., 2022), Yemen (van Harten et al., 2020), and many others. In Arabia, reported as more or less common in cultivation in Yemen (Wood, 1997), where it was found naturalized in Haraz. New alien species for Fujairah and UAE. In Fujairah, we found it wild in Al Bidya and in the city of Dibba. Usually grows on fences and walls, occasionally self-seeding around plantings. Also, we observed this plant in a natural dump in a

pit at an abandoned construction site, where it grew in mass. It is not a potentially invasive species.

Phaseolus lunatus L.: "UAE. Mts. Hajar. Old road Masafi – Dibba, gardens in NW environs of vil. Al Khala, 25°29'02.84"N, 56°11'22"E, ca. 180 m alt.: weed in the private garden, liana on fence, in mass. – ОАЭ, Фуджейра, горы Хаджар. Старая дорога Масафи – Дибба, сады в сев.-зап. окр. пос. Аль-Хала, 25°29'02.84"N, 56°11'22"E, ок. 180 м над ур. м.: сорняк, густо оплетающий забор в частном саду (с обратной стороны сада). 23 XI 2019. [Fl.] V. V. Byalt, M. V. Korshunov 1469" (LE01065682). – Terophyte or liana / Annual or perennial liana. Distribution by seeds, ballistochorous (Fig. 2, 6).

Phaseolus lunatus has an American origin, from Mexico in North America to Colombia in South America (Jørgensen et al., 2013; Forzza et al., 2016; Ruiz et al., 2016; Villaseñor, 2016; POWO, 2024). Listed as an introduced alien species for 32 countries (Boulvert, 1977; Webb et al., 1988; Lock, 1989; *Phaseolus lunatus*…, 2020; etc.) and included in the lists of invasive species in the USA (Kraus et al., 2020), Australia (Lepschi, Monro, 2014; Randall et al., 2020), Ecuador (Causton et al., 2020) and many others. Study of the pertinent literature revealed that this species has not been reported from the Arabian Peninsula so far (Collenette, 1989, 1999; Cornes C. D., Cornes M. D., 1989; Migahid, 1989; Wood, 1997; Jongbloed et al., 2003; Ghazanfar, 2007; Karim, Fazwi, 2007; Norton et al., 2009; etc.). Found by us in Fujairah in the mass on the fence of the garden on the opposite side of the gate in the vicinity of the village of Al Halla (near Mazafi). Apparently, it was previously planted, but now it is supported by self-sowing and grows without any care and fruitful. A new alien species for Fujairah, UAE and Arabia as a whole.

Pueraria tuberosa (Roxb. ex Willd.) DC.: "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, 44 m [point 795]: weed in and between plastic pots with cultivated *Cycas* and another trees. 8 VI 2020. [Veg.] V. V. Byalt, M. V. Korshunov 3505 (FSH). – Geophyte liana / Tuber liana. Distributed with seeds and tubers (Fig. 3, 5C, 8A).

The native area of this species is Indian Subcontinent. It is a climbing perennial with tubers and grows primarily in the wet tropical biomes (POWO, 2024+). Until now, it has not been reported as an alien species for other regions of the World (*Pueraria tuberosa*, 2022; POWO, 2024+), including the Arabian Peninsula. Found by us in large numbers at "The Green Nursery Sales Dibba", in Dibba, where it has grown as weed in pots and between pots with *Cycas, Zamia* and some other young tree plants cultivated for sale. It is a vine with trifoliate leaves and very characteristic light brown tubers (Fig. 5C, 8A). New alien adventive species for Fujairah, UAE and Arabia as a whole. It is not an invasive species due to its high moisture-loving nature and can be weed only in places with good irrigation.

Tephrosia subtriflora Hochst. ex Baker: "UAE. Emirate of Fujairah, environs of Al Fujeirah, relict forest near Sheikh palace, 25°8'24.34"N, 56°18'39.14"E, in woodland and bushes. – ОАЭ, Фуджейра, окр. г. Фуджейра, реликтовый лес около дворца шейха. 25°8'24.34"N, 56°18'39.14"E, редкий лес и кустарники. 14 XII 2017. [Fl.] V. V. Byalt 695" (LE 01194462!); "UAE, EF, Al Dibba town, 25°36'59.8"N, 56°18'40.02"E, 12 m alt., an alley near the stadium and adjacent streets on the border with Oman: in a vacant lot. – ОАЭ, Фуджейра, г. Дибба, 25°36'59.8"N, 56°18'40.02"E, 12 м над ур. м., аллея около стадиона и прилегающие улочки на границе с Оманом: на пустыре между домов, у мусорного бака. 21 XI 2019. [Fl.] V. B. Byalt, M. V. Korshunov 1402" (LE); "UAE, Emirate, Rul Dhadna, gardens 0.5 km to East from Dhadna Port. 25°31'26.73"N, 56°21'53.68"E, 6 m [point 754]: in gravel-sand wadi near gardens, 17 IV 2020. [Fl.] V. V. Byalt, M. V. Korshunov 2174" (LE 01229186). – Hemicryptophyte / Perennial herb. Native species (Fig. 3, 7).

The native area of this species is Cape Verde to Eritrea and Tanzania, Angola, Madagascar, Arabian Peninsula, Indian Subcontinent to Myanmar. It grows primarily in the seasonally dry tropical biomes (Rechinger, Podlech, 1984; Lock, 1989; Hedberg, Edwards, 1990; Thulin, 1993; Du Puy et al., 2002; Kumar, Sane, 2003; Pickering, Darbyshire, 2015; *Tephrosia subtriflora*…, 2024; POWO, 2024; etc.), as well as all of Arabia except for the UAE and Qatar (Wood, 1997; Miller and Morris, 2004; Ghazanfar, 2007; Mosti et al., 2012). New alien species for Fujairah and the UAE. We found this species several times in the city of Al Dibba in a garbage place and in Rul Dadna at the bottom of a wadi among a village with a large number of weeds, where several flowering specimens were collected that grew on a gravelly substrate, and in the relict forest of Sheikh in the environs of Fujairah City among the bushes. It occurs quite rarely but both in disturbed and natural habitats.

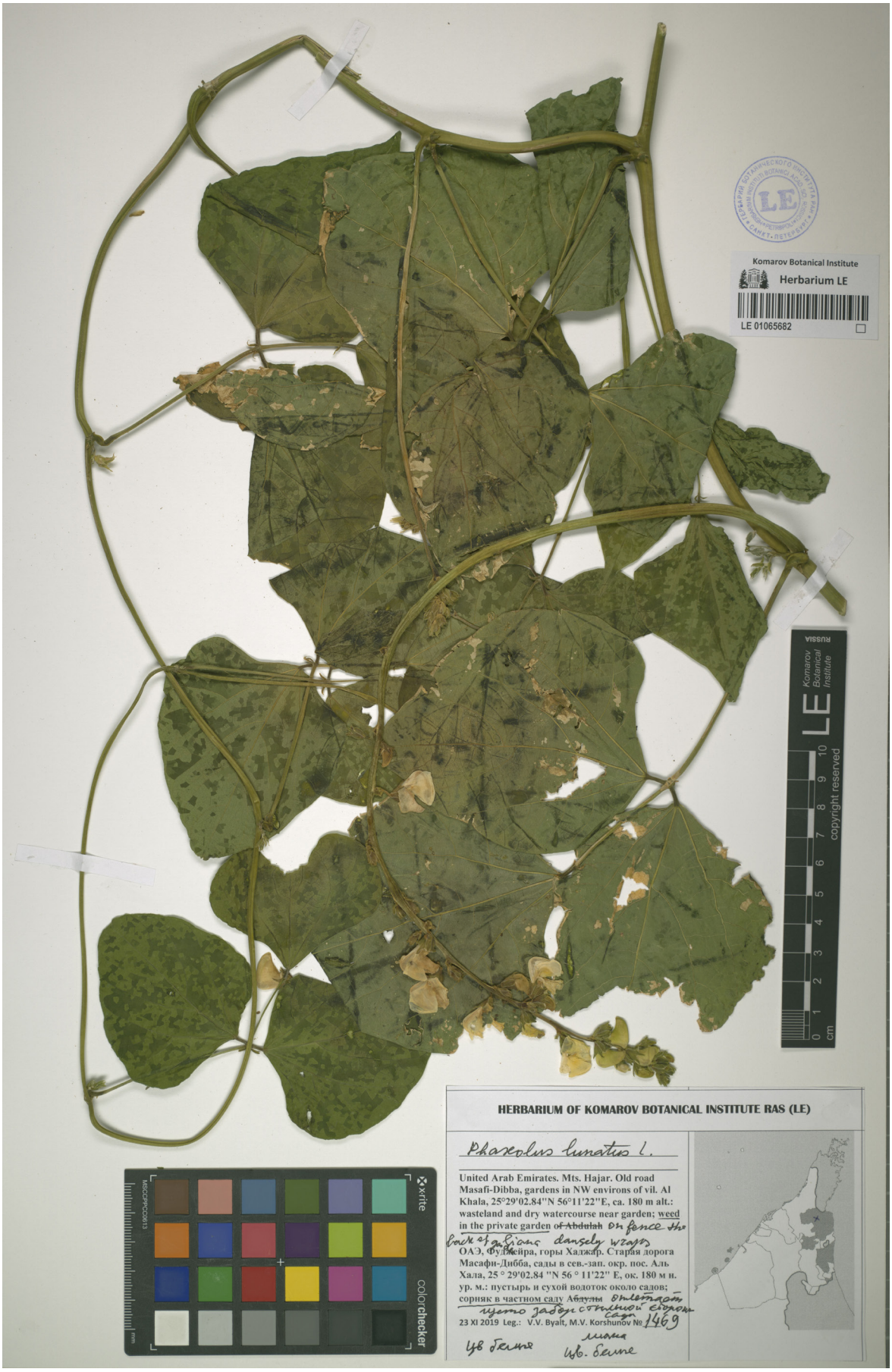

Fig. 6. Herbarium specimen of *Phaseolus lunatus* from environs of village Al Khala kept in LE (LE 01065682, scan by M. Legchenko).

Fig. 7. Herbarium specimen of *Tephrosia subtriflora* collected in wadi in Rul Dadna, kept in LE (LE 01229186, scan by M. Legchenko)

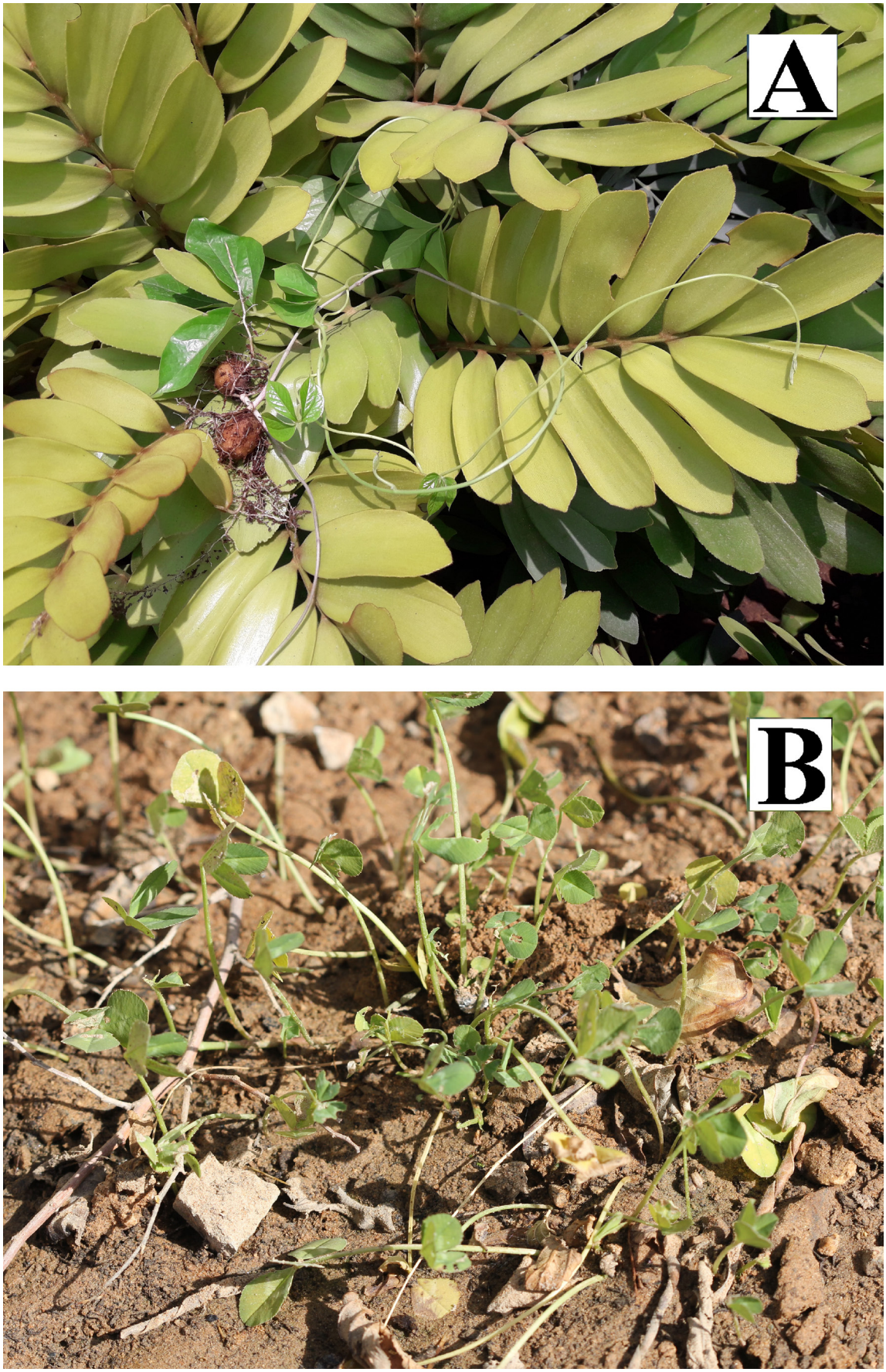

Fig. 8. New alien plants in Emirate of Fujairah: A – young plant with tubers of *Pueraria tuberosa* on *Zamia* in plant nursery at Al Dibba town (photo by M. Korshunov); B – *Trifolium repens* – grows in irrigated pit under *Ziziphus spina-christi* in Wadi Wurayah Centre of Bioreproduction of Arabian tars (photo by V. Byalt).

Trifolium alexandrinum L.: "UAE, Fujairah emirate, Al Wahlah, wadi Al Hilo Fort (Ohala Fort). 24°54'29.51"N, 56°18'11.86"E, 75 m [point 334]: weed in irrigated garden, on partly abandoned orchard. 19 III 2020. [Fl.] V. B. Byalt, M. V. Korshunov 831" (LE 01193804). – Terophyte/Annual. Xenophyte (Ergasiophygophyte?), colonophyte, euneophyte. Distribution by seeds (Fig. 3, 5D). Comes from the North-East Africa, Middle-East and South-West Asia (Pakistan and Iran) (Lock, 1989; Yakovlev et al., 1996; Lock, Ford, 2004; Dobignard, Chatelain, 2012; *Trifolium alexandrinum*…, 2019; etc.) for UAE, it is listed as natural (POWO, 2024), which is undoubtedly a mistake, since we have never met it in nature in the mountains. Listed as an alien species in 20 countries of the world (Yakovlev et al., 1996; Lock, Ford, 2004; Wu, Raven, 2010; Dimopoulos et al., 2013; POWO, 2024; *Trifolium alexandrinum*…, 2024; etc.). It is included in the lists of introduced and invasive species in the USA (Kraus et al., 2020), Belgium (Desmet et al., 2020), Australia (Lepschi, Monro, 2014; Randall et al., 2020) and others. One time it was found in the Kalba which is the enclave of Sharjah emirate on the coast of the Gulf of Oman (UAE: Kalba oasis, east coast, approx. 2 km in land. 20 II 1985. R. A. Western 718 (E) (Western, 1989; Jongbloed et al., 2000, 2003). We found this species once in a garden at the bottom of the large wadi Al Hilo (Al Hilo) near the village of Al Wahlah, where it weeds on the site of a semi-abandoned garden. Apparently it was previously cultivated, and now runs wild in abandoned garden beds. A new alien species for Fujairah. It is not a potentially invasive species.

Trifolium pratense L. – only photographs available, specimen was not collected [UAE. Emirate of Fujairah, Wadi-Wurayah National Park, 8 km NW from Khor Fakkan, Centre of Bioreproduction, ca. 25°23'N, 56° 18'E, 150 m alt.: irrigated spot under trees. 5 IV 2018. [Veg.] photo by M. V. Korshunov]. – Hemicryptophyte/Perennial. Distribution by seeds (Fig. 3, 5E).

The native range of this species is Macaronesia, NW. Africa, Europe to Mongolia and Himalaya (POWO, 2024). Recorded as introduced in 26 countries of the World (*Trifolium pratense*, 2024), in some countries it is invasive in more or less temperate conditions, for example, in USA (Simpson et al., 2023), South Africa (Robinson et al., 2020), Argentina (Zalba et al., 2021), Australia (Randall et al., 2022), New Zealand (Webb et al., 1988), etc. At the same time, this species has not yet been reported for the Arabian Peninsula.

It is a perennial and grows primarily in the temperate biome. It is used as animal and invertebrate food, in medicine, has environmental uses (melioration), etc. (POWO, 2024). Not previously reported for the UAE (see Western, 1989; Jongbloed et al., 2000, 2003; Karim, Fawzi, 2007; etc.). In Fujairah, it was accidentally introduced (apparently with hay for Arabian tars), and we observed it in a single exemplar among the plantings of *Ziziphus spina-christi* during one season from autumn to spring of the next year (Fig. 5E). In the summer heat, it died from extreme conditions while not blooming. It is not a potentially invasive species, as it is a temperate species and is poorly adapted to dry tropical climates. Apparently, this is typical for most European species, which can normally grow in Arabia only high in the mountains at altitudes of 2000–4000 m above sea level (Wood, 1997; Ghazanfar, 2007).

Trifolium repens L.: "UAE. Emirate of Fujairah, Wadi Wurayah National Park, 8 km NW from Khor Fakkan, Centre of Bioreproduction, ca. 25°23'N, 56°18'E, 150 m alt.: irrigated spot under trees. 5 IV 2018. [Veg.] V. V. Byalt 1315" (LE 01194481). – Hemicryptophyte/Perennial. Distribution by seeds (Fig. 3, 8B).

Western-eurasian-African species. The native range of this species is Macaronesia, NW. Africa, Egypt to Zimbabwe, Europe to Mongolia and Himalaya (POWO, 2024). It is a perennial and grows primarily in the temperate biome. It is used as animal and invertebrate food, a poison (linamarin), in medicine and environmental uses and for human food (POWO, 2024). Recorded as introduced in 43 countries or islands (*Trifolium repens*, 2024) and invasive in USA (Simpson et al., 2023), Australia (Randall et al., 2022), South Africa (Robinson et al., 2020), Colombia (Piedad et al., 2022), some regions of Russia (Petrosyan et al., 2020), etc. On the website GBIF (2024) there are no indications of the distribution of this species in Arabia, but there are records in other sources of its findings in the UAE (Mahmoud et al., 2015b) and Qatar (https://www.floraofqatar.com/indexf.htm#Fabaceae). In Qatar, flowering plants were found by A. Sergeev from Texas (USA) on dark background taken from Mareb Street in Onaiza area, Doha at April 18, 2016. A rare alien species for the UAE, previously recorded for the sandy shoulder of a highway in the emirate of Dubai (Mahmoud et al., 2015b). It was accidentally introduced in Fujairah (apparently with hay for containers) and we observed it in the irrigation circles of *Ziziphus spina-christi* for several seasons,

but it never bloomed (Fig. 8B). Apparently, as well as *T. pratense*, it is not a potentially invasive species, since it is also a plant of the temperate zone and is poorly adapted to a dry tropical climate. A new record of alien species for the emirate of Fujairah.

Trifolium resupinatum L.: "UAE, Fujairah emirate, Al Wahlah, wadi Al Hilo Fort (Ohala Fort). 24°54'29.51"N, 56°18'11.86"E, 75 m. [point 334]: weed in irrigated garden, on partly abandoned orchard. 19 III 2020. [fl., fr.] V. V. Byalt, M. V. Korshunov 833" (FHS); "UAE, Fujairah Emirate, village Bithna, villas with gardens. 25°11'27.92"N, 56°13'59.54"E, 190 m. [point 723]: on roadside in irrigated spots, weed. 30 III 2020 [Fl., fr.] V. V. Byalt, M. V. Korshunov 1324" (LE 01193792). – Terophyte/Annual. Distribution by seeds (Fig. 3, 5F).

The natural range of the species covers the Mediterranean, Middle East and South-West Asia (Afghanistan, Pakistan, Iran) (Tutin et al., 1968; Rechinger, Podlech, 1984; Greuter et al., 1989; Boulos, 1999; Dobignard, Chatelain, 2012; Haerinasab, Rahiminejad, 2012; *Trifolium resupinatum*…, 2020; POWO, 2024; etc.). Although the "Plants of the World On line" website (POWO, 2024) states that *T. resupinatum* is a wild species in the UAE, as in Qatar, this is not the case. In the UAE, it is listed only for Abu Dhabi (Western, 1989; Jongbloed et al., 2000, 2003), where it is undoubtedly alien. And in Qatar, it is also considered as introduced (Norton et al., 2009). We found this plant running wild in a partially abandoned orchard garden in Wadi Al Hilo, near settlement Al Wala in southern Fujairah (together with *T. alexandrinum*) and as weed in irrigated spot on roadside in village Bithna. A new record of alien species for Fujairah.

Conclusions

As our new research has shown, similar processes are taking place in Fujairah Emirate with a much more arid climate. However, alien plants invise here exclusively in anthropogenic habitats, practically not penetrating into coastal, desert or mountain phytocenoses, since all the finds were made in disturbed habitats – in plant nurseries, in 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. There is a clear correlation between the increase in the number of alien species and the intensification of economic activity in the region. With the development of the transport network, they penetrate the mountains along the roadsides. In Fujairah, plant nurseries appear to be an important source of introduction of new alien species. The penetration of a large number of alien species of Fujairah is likely to have occurred in the last two decades, when developmental projects in emirate have been on the increase.

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