



Computer-generated keys to the flora of Egypt. 11. The Polygonaceae

Adel El-Gazzar¹, Lamiaa F. Shalabi^{2*}, Atia M. Eisa³, and Adel A. Khattab⁴

¹Botany Department, Faculty of Science, El-Arish University, El-Arish, N. Sinai, Egypt

²Biological and Geological Department, Faculty of Education, Ain Shams University, Heliopolis, Cairo, Egypt

³Botany and Microbiology Department, Faculty of Science, Damanhur University, El-Beheira, Egypt

⁴ Botany and Microbiology Department, Faculty of Science, Cairo University, Giza, Egypt

* Corresponding author: flora_lamiaa@yahoo.com

Abstract

A data matrix was compiled to accommodate the variation in 35 easily observable characters recorded comparatively from about 650 herbarium specimens of 26 species representing the eight genera of the Polygonaceae in the flora of Egypt. Only the characters with relatively sufficient constancy in all specimens of the same species were selected to warrant their use in the discrimination between the taxa. The DELTA key-generating package of computer programs was used to construct a conventional key to all genera and species. Only 14 of the recorded characters were sufficient for key construction. An unedited version of the detailed description of every species in terms of the entire set of 35 characters is provided; surplus characters aid in confirming its identification. Item descriptions, along with the list of characteristics, can be used to re-synthesize the original data matrix, which can then be adjusted to include more characters and/or taxa. The key and descriptions have several advantages over their manually constructed predecessors.

Key Words: conventional key, DELTA, descriptions, identification,

morphological characters

Introduction

The Polygonaceae Juss. (*nom. cons.*) were established as “Ordo Polygoneae” by de Jussieu (1789) to accommodate nine genera: *Coccoloba*, *Atraphaxis*, *Polygonum* (incl. *Fagopyrum*, *Bistortia* and *Persicaria*), *Rumex* (incl. *Acetosa* and *Lapathum*), *Triplaris*, *Calligonum* (incl. *Polygonoides*), *Pallasia* (including *Pterococcus*), *Rheum* and *Koenigia*. The latest account of the family shows that the numbers of genera and species in the Polygonaceae increased to 56 genera with 1266 species and numerous taxa of infra-specific rank (The Plant List 2019). The species are unevenly distributed between the genera: about 75% of the species are aggregated

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in only five genera (*Calligonum* with 158 spp., *Coccoloba* with 177 spp., *Eriogonum* with 255 spp., *Polygonum* with 217 spp., and *Rumex* with 152 spp.), whereas 21 genera are monospecific and no less than 17 genera consist of 2-3 species each (Sanchez et al. 2009). In the phylogenetic classification proposed by APG III (2009), the Polygonaceae are placed in the Caryophyllales, while Takhtajan (2009) isolated this family in a separate order, the Polygonales.

The plants are commonly herbs or shrubs and rarely trees or lianas, glabrous to white-tomentose, and monoecious or diecious. Leaves simple or 5-lobed, alternate, rarely opposite, and foliaceous; in *Calligonum* the stem is articulated, and the leaves are reduced to small caducous scales so that the plant assumes an *Ephedra*-like appearance. Leaves have a peculiar pair of fused, sheathing stipules known as an ochrea, scarious or membranous. Flowers in cymose or racemose inflorescence sometimes solitary; actinomorphic, uni- or bisexual with a uniseriate perianth of 3-6 petaloid tepals, free or shortly connate at base. Stamens 5-8, free or connate. Gynoecium of 3 united carpels; ovary superior unilocular with a single basal orthotropous, anatropous, or slightly campylotropous and unitegmatic ovule; style one with three capitate or flat stigmas. Fruit is usually a 3-ridged achene or drupe, with three more or less broad and multi-nerved wings (Watson & Dallwitz 1992 onwards; Brandbyge 1993; Freeman & Reveal 2005; Judd et al. 2008; Anjen et al. 2003). The Polygonaceae are traditionally divided into two subfamilies: Polygonoideae and Eriogonoideae based on ochrea presence and habit; while the former subfamily is cosmopolitan, the latter is confined to the New World (Anjen et al. 2003). The plants seem to thrive in almost every conceivable habitat type, ranging from parched sand dunes and rocky hillsides to shady garden hedges and freshwater ponds (Reveal 1978).

The Polygonaceae are represented in the flora of Egypt by eight genera comprising 28 species with four subspecies and one variety (Boulos 2009), none of which is reported to be of notable economic importance, except that some *Persicaria* species are known to be important wetland plants because they provide food for waterfowl, and a few species of *Muehlenbeckia* and *Antigonon* are grown as garden ornamentals. Conventional keys to the genera and species were provided by Muschler (1912), Ramis (1929), Montasir & Hassib (1956), Täckholm (1956, 1974), and Boulos (1999). However, these keys are manually constructed and while some are relatively easier to use than others, they all suffer from one or more of the following drawbacks: (i) characters are used singly to diagnose the great majority of the couplets, (ii) states of the same character are often overlapping, and (iii) distinction between a pair of entries in the same couplet may not be strictly comparative in the sense that while one entry is diagnosed by a character-state of one organ, the other alternative entry might be defined by a character-state of another organ. To redress these pitfalls and obviate the difficulties associated with the identification of representatives of the Polygonaceae in the flora of Egypt, the present

study was undertaken to score variation in the largest possible number of characters exhibited by the plants in a collective data matrix which can be subjected to analysis using a key-generating package of computer programs.

Materials and Methods

Although Boulos (1999, 2009) reported the presence of 28 species of Polygonaceae in Egypt, about 650 herbarium specimens of only 26 species were found in the largest two herbaria in the country: CAI (herbarium of the Botany Department, Faculty of Science, Cairo University), and CAIM (herbarium of the Flora and Phytotaxonomic Researches Unit, Agriculture Museum, Ministry of Agriculture, Cairo); acronyms are according to Thiers (Thiers 2022). The specimens were examined for easily observable aspects of vegetative and floral variation which were recorded comparatively in a data matrix. The number of specimens representing each species in the present study ranged between 1 and 25. The collection data and accepted names of the studied taxa are given in Table (1). Identity of every species was re-affirmed using local floras of Egypt and neighboring countries (e.g. Andrews 1950; Zohary 1966a & 1966b; Boulos 1999). Updating the nomenclature of the studied taxa was carried out using the two websites: The plant list (TPL, 2019 <http://www.theplantlist.org>) and Tropicos (2022, <https://tropicos.org>), where some synonymy of the accepted names can be found.

A data matrix was designed to score the distribution of the 35 characters and their character-states among the 26 species; Stearn's (1966) glossary of botanical terminology was used to ensure consistency in the use of the descriptive terms defining those states. The data set was analyzed using the DELTA software, which is a multi-purpose format for generating both conventional and interactive identification keys (Dallwitz et al. 1993 onwards; Dallwitz & Paine 2005; Dallwitz 2010; <http://delta-intkey.com>; www.sourceforge.net).

Results

A catalogue of 35 characters expressed in representatives of the Polygonaceae in Egypt by 84 character-states was compiled. The character list, the key to genera and species, their detailed and item descriptions are as follows:

1. List of Characters and character states

#1. Plant/ 1. annual/ 2. perennial/

#2. Plant/ 1. herb/ 2. shrub/

#3. Average height/ 1. less than 20 cm/ 2. 20–80 cm/ 3. more than 80 cm/

#4. Stem/ 1. erect/ 2. prostrate-decumbent/ 3. twining/

#5. Stem/ 1. glabrous/ 2. woolly/ 3. with rough white bark/

#6. Stem branching/ 1. lateral/ 2. from the base/

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- #7. Stem/ 1. white striated/ 2. green-reddish brown/
- #8. Stem/ 1. terete/ 2. angled/
- #9. Leaves/ 1. simple/ 2. 5-lobed/
- #10. Leaves/ 1. persistent/ 2. deciduous/
- #11. Leaves/ 1. glabrous/ 2. woolly/
- #12. Leaves/ 1. symmetrical/ 2. asymmetrical/
- #13. Leaves/ 1. orbicular/ 2. ovate/ 3. deltoid/ 4. sagittate/ 5. lanceolate/
- #14. Leaf blade length/ 1. less than 1 cm/ 2. 1–8 cm/ 3. more than 8 cm/
- #15. Leaf blade width/ 1. less than 0.8 cm/ 2. 0.8–2 cm/ 3. more than 2 cm/
- #16. Leaf margin/ 1. entire/ 2. undulate/
- #17. Leaf margin/ 1. flat/ 2. revolute/
- #18. Leaf apex/ 1. obtuse/ 2. acute/ 3. acuminate/
- #19. Ochrea/ 1. bifid-laciniate/ 2. connate/
- #20. Ochrea length/ 1. less than 1 cm/ 2. 1–2.5 cm/ 3. more than 2.5 cm/
- #21. Ochrea/ 1. transparent/ 2. pink/
- #22. Petiole/ 1. 1 cm or less/ 2. more than 1 cm/
- #23. Inflorescence/ 1. axillary cluster/ 2. spike/ 3. raceme/
- #24. Flowers/ 1. unisexual/ 2. bisexual/
- #25. Flowers/ 1. pedicelled/ 2. sessile/
- #26. Perianth segments/ 1. 4/ 2. 5/ 3. 6/
- #27. Perianth segments/ 1. pink/ 2. pale green/ 3. white/
- #28. Perianth tube/ 1. present/ 2. absent/
- #29. Stamens/ 1. 5/ 2. 6/ 3. more than 6/
- #30. Style and stigma/ 1. one/ 2. two/ 3. three/
- #31. Nutlet/ 1. brownish/ 2. greenish/ 3. red/ 4. black/
- #32. Nutlet/ 1. trigonous/ 2. oblong/ 3. lenticular/ 4. biconvex/
- #33. Nutlet/ 1. shiny/ 2. dull/
- #34. Nutlet surface/ 1. granulate/ 2. smooth/ 3. with stiff bristles/
- #35. Fruit wings/ 1. present/ 2. absent/

2. The conventional key

Characters: 35 indata, 35 included, 14 in key.

Items: 26 in data, 26 included, 26 in key.

Parameters: Rbase = 1.40 Abase = 2.00 Reuse = 1.01 Varywt = .80

Characters included: 1–35

Character reliabilities: 1–35, 5.0

- | | | |
|-------|--|---|
| 1. | Leaves orbicular | 2 |
| | Leaves ovate | 5 |
| | Leaves deltoid | 7 |
| | Leaves sagittate | 8 |
| 2(1). | Nutlet trigonous..... | 3 |
| | Nutlet oblong..... <i>Atraphaxis spinosa</i> var. <i>sinaica</i> | |

	Nutlet lenticular	<i>Calligonum comosum</i>	
	Nutlet biconvex	<i>Polygonum maritimum</i>	
3(2).	Leaf apex obtuse		4
	Leaf apex acute	<i>Rumex cyprius</i>	
	Leaf apex acuminate.....	<i>Persicaria lanigera</i>	
4(3).	Average height less than 20 cm; leaves asymmetrical; leaf margin entire; perianth segments pink	<i>Rumex simpliciflorus</i>	
	Average height 20-80 cm; leaves symmetrical; leaf margin undulate; perianth segments white	<i>Rumex roseus</i>	
5(1).	Leaf blade width less than 0.8 cm; inflorescence axillary cluster; nutlet red	<i>Emex spinosa</i>	
	Leaf blade width 0.8-2 cm; inflorescence spike; nutlet greenish		6
	Leaf blade width more than 2 cm; inflorescence raceme; nutlet brownish	<i>Rumex vesicarius L.</i>	
6(5).	Average height less than 20 cm; perianth tube absent	<i>Oxygonum sinuatum</i>	
	Average height 20-80 cm; perianth tube present.....	<i>Oxygonum atriplicifolium</i>	
7(1).	Leaf blade width less than 0.8 cm; inflorescence spike; nutlet black; average height more than 80 cm	<i>Fallopia convolvulus</i>	
	Leaf blade width more than 2 cm; inflorescence axillary cluster; nutlet brownish; average height less than 20 cm	<i>Rumex pictus</i>	
8(1).	Leaf blade width less than 0.8 cm		9
	Leaf blade width 0.8-2 cm.....		10
	Leaf blade width more than 2 cm		13
9(8).	Stamens 5	<i>Polygonum plebeium</i>	
	Stamens 6	<i>Polygonum bellardii</i>	
	Stamens more than 6	<i>Polygonum patulum</i>	
10(8).	Stamens 5	<i>Persicaria decipiens</i>	
	Stamens 6		11
	Stamens more than 6		12
11(10).	Leaves symmetrical; leaf apex acute; inflorescence raceme; average height 20-80 cm	<i>Rumex pulcher</i>	
	Leaves asymmetrical; leaf apex obtuse; inflorescence spike; average height less than 20 cm.....	<i>Rumex bucephalophorus</i>	
12(10).	Inflorescence axillary cluster; perianth segments pale green; average height 20-80 cm; nutlet trigonous	<i>Polygonum aviculare</i>	
	Inflorescence raceme; perianth segments pink; average height more than 80 cm; nutlet lenticular	<i>Polygonum equisetiforme</i>	
13(8).	Leaf apex obtuse		14
	Leaf apex acute		15
	Leaf apex acuminate.....	<i>Persicaria senegalensis</i>	
14(13).	Average height 20-80 cm; nutlet surface granulate	<i>Rumex dentatus subsp. mesopotamicus</i>	

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- Average height more than 80 cm; nutlet surface smooth ... *Rumex dentatus* subsp. *dentatus*
15(13). Leaf margin entire; inflorescence raceme; nutlet black;
stem branching lateral *Persicaria lapathifolia*
Leaf margin undulate; inflorescence spike; nutlet brownish;
stem branching from the base *Rumex crispus*

3. Detailed descriptions

Atraphaxis spinosa L. var. *sinaica* (Jaub. & Spach) Boiss.

Plant perennial, shrub. Average height 20–80 cm. Stem erect, with rough white bark, branching lateral, white striated, angled. Leaves, persistent, glabrous, symmetrical, orbicular. Leaf blade length less than 1 cm. Leaf blade width less than 0.8 cm. Leaf margin entire, flat. Leaf apex obtuse. Ochrea bifid-laciniate, length less than 1 cm, pink. Petiole 1 cm or less. Inflorescence axillary cluster. Flowers bisexual, sessile. Perianth segments 4, pink. Perianth tube absent. Stamens 6. Style and stigma two. Nutlet brownish, oblong, shiny. Nutlet surface smooth. Fruit wings absent.

Calligonum comosum L'Hér.

Plant perennial, shrub. Average height more than 80 cm. Stem erect, glabrous, branching lateral, green-reddish brown, terete. Leaves simple, deciduous, glabrous, symmetrical, orbicular. Leaf blade length less than 1 cm. Leaf blade width less than 0.8 cm. Leaf margin entire, flat. Leaf apex obtuse. Ochrea bifid-laciniate. Ochrea length less than 1 cm. Ochrea transparent. Petiole 1 cm or less. Inflorescence axillary cluster. Flowers bisexual, pedicelled. Perianth segments 5, pale green. Perianth tube absent. Stamens more than 6. Style and stigma three. Nutlet greenish, lenticular, shiny. Nutlet surface with stiff bristles. Fruit wings absent.

Emex spinosa (L.) Campd.

Plant annual, herb. Average height 20–80 cm. Stem prostrate-decumbent, glabrous, branching from the base, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, ovate. Leaf blade length less than 1 cm. Leaf blade width less than 0.8 cm. Leaf margin undulate, flat. Leaf apex acute. Ochrea connate. Ochrea length less than 1 cm. Ochrea transparent. Petiole 1 cm or less. Inflorescence axillary cluster. Flowers unisexual, sessile. Perianth segments 6, pink. Perianth tube absent. Stamens 6. Style and stigma three. Nutlet red, trigonous, shiny. Nutlet surface with stiff bristles. Fruit wings absent.

Fallopia convolvulus (L.) Á. Löve

Plant annual, herb. Average height more than 80 cm. Stem twining, glabrous, branching lateral, green-reddish brown, angled. Leaves simple, persistent, glabrous, symmetrical, deltoid. Leaf blade length less than 1 cm. Leaf blade width less than

0.8 cm. Leaf margin entire, flat. Leaf apex acuminate. Ochrea connate. Ochrea length less than 1 cm. Ochrea pink. Petiole more than 1 cm. Inflorescence spike. Flowers bisexual, pedicelled. Perianth segments 5, pale green. Perianth tube absent. Stamens more than 6. Style and stigma three. Nutlet black, trigonous, dull. Nutlet surface granulate. Fruit wings absent.

Oxygonum atriplicifolium (Meisn.) Martelli

Plant annual, herb. Average height 20–80 cm. Stem prostrate-decumbent, glabrous, branching from the base, green-reddish brown, terete. Leaves 5-lobed, persistent, glabrous, symmetrical, and ovate. Leaf blade length 1–8 cm. Leaf blade width 0.8–2 cm. Leaf margin entire, flat. Leaf apex acute. Ochrea connate. Ochrea length less than 1 cm. Ochrea transparent. Petiole more than 1 cm. Inflorescence spike. Flowers bisexual, pedicelled. Perianth segments 6, white. Perianth tube present. Stamens more than 6. Style and stigma three. Nutlet greenish, trigonous, shiny. Nutlet surface smooth. Fruit wings absent.

Oxygonum sinuatum (Hochst. & Steud. ex Meisn.) Dammer

Plant annual, herb. Average height less than 20 cm. Stem prostrate-decumbent, glabrous, branching from the base, green-reddish brown, terete. Leaves 5-lobed, persistent, glabrous., symmetrical, ovate. Leaf blade length 1–8 cm. Leaf blade width 0.8–2 cm. Leaf margin entire, flat. Leaf apex acute. Ochrea connate. Ochrea length less than 1 cm. Ochrea transparent. Petiole more than 1 cm. Inflorescence spike. Flowers bisexual, pedicelled. Perianth segments 6, white. Perianth tube absent. Stamens more than 6. Style and stigma three. Nutlet greenish, trigonous, shiny. Nutlet surface smooth. Fruit wings absent.

Persicaria decipiens (R.Br.) K.L. Wilson

Plant perennial, herb. Average height 20–80 cm. Stem erect, glabrous, branching lateral, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, sagittate. Leaf blade length more than 8 cm. Leaf blade width 0.8–2 cm. Leaf margin entire, flat. Leaf apex acute. Ochrea connate. Ochrea length 1–2.5 cm. Ochrea transparent. Petiole 1 cm or less. Inflorescence raceme. Flowers bisexual, pedicelled. Perianth segments 5, pink. Perianth tube absent. Stamens 5. Style and stigma three. Nutlet black, oblong, shiny. Nutlet surface smooth. Fruit wings absent.

Persicaria lanigera (R.Br.) Soják

Plant perennial, herb. Average height 20–80 cm. Stem erect, woolly, branching lateral, green-reddish brown, terete. Leaves simple, persistent, woolly, symmetrical, and orbicular. Leaf blade length more than 8 cm. Leaf blade width more than 2 cm. Leaf margin entire, flat. Leaf apex acuminate. Ochrea connate. Ochrea length 1–2.5

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cm. Ochrea transparent. Petiole more than 1 cm. Inflorescence spike. Flowers bisexual, sessile. Perianth segments 5, pink. Perianth tube absent. Stamens 6. Style and stigma two. Nutlet black, trigonous, shiny. Nutlet surface smooth. Fruit wings absent.

Persicaria lapathifolia (L.) Delarbre

Plant annual, herb. Average height 20–80 cm. Stem erect, glabrous, branching lateral, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, sagittate. Leaf blade length more than 8 cm. Leaf blade width more than 2 cm. Leaf margin entire, flat. Leaf apex acute. Ochrea connate. Ochrea length 1–2.5 cm. Ochrea transparent. Petiole 1 cm or less. Inflorescence raceme. Flowers bisexual, sessile. Perianth segments 4, pink. Perianth tube absent. Stamens 6. Style and stigma two. Nutlet black, trigonous, shiny. Nutlet surface smooth. Fruit wings absent.

Persicaria senegalensis (Meisn.) Soják

Plant perennial, herb. Average height more than 80 cm. Stem erect, glabrous, branching lateral, green-reddish brown, terete. Leaves simple, persistent, woolly, symmetrical, sagittate. Leaf blade length more than 8 cm. Leaf blade width more than 2 cm. Leaf margin undulate, flat. Leaf apex acuminate. Ochrea connate. Ochrea length more than 2.5 cm. Ochrea pink. Petiole more than 1 cm. Inflorescence raceme. Flowers bisexual, pedicelled. Perianth segments 5, pink. Perianth tube present. Stamens more than 6. Style and stigma two. Nutlet black, trigonous, dull. Nutlet surface smooth. Fruit wings absent.

Polygonum aviculare L.

Plant annual, herb. Average height 20–80 cm. Stem prostrate-decumbent, glabrous, branching from the base, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, sagittate. Leaf blade length 1–8 cm. Leaf blade width 0.8–2 cm. Leaf margin entire, flat. Leaf apex acute. Ochrea connate. Ochrea length less than 1 cm. Ochrea transparent. Petiole 1 cm or less. Inflorescence axillary cluster. Flowers bisexual, pedicelled. Perianth segments 5, pale green. Perianth tube absent. Stamens more than 6. Style and stigma one. Nutlet brownish, trigonous, dull. Nutlet surface smooth. Fruit wings absent.

Polygonum bellardii All.

Plant annual, herb. Average height less than 20 cm. Stem erect, glabrous, branching lateral, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, sagittate. Leaf blade length 1–8 cm. Leaf blade width less than 0.8 cm. Leaf margin entire, flat. Leaf apex acute. Ochrea connate. Ochrea length less than 1

cm. Ochrea transparent. Petiole 1 cm or less. Inflorescence axillary cluster. Flowers bisexual, sessile. Perianth segments 5, pink. Perianth tube absent. Stamens 6. Style and stigma one. Nutlet black, trigonous, dull. Nutlet surface smooth. Fruit wings absent.

***Polygonum equisetiforme* Sm.**

Plant perennial, herb. Average height more than 80 cm. Stem prostrate-decumbent, glabrous, branching lateral, green-reddish brown, terete. Leaves simple, deciduous, glabrous, symmetrical, sagittate. Leaf blade length 1–8 cm. Leaf blade width 0.8–2 cm. Leaf margin entire, flat. Leaf apex acute. Ochrea bifid-laciniate. Ochrea length less than 1 cm. Ochrea pink. Petiole 1 cm or less. Inflorescence raceme. Flowers bisexual, pedicelled. Perianth segments 5, pink. Perianth tube absent. Stamens more than 6. Style and stigma one. Nutlet brownish, lenticular, shiny. Nutlet surface smooth. Fruit wings absent.

***Polygonum maritimum* L.**

Plant perennial, herb. Average height less than 20 cm. Stem prostrate-decumbent, glabrous, branching lateral, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, orbicular. Leaf blade length 1–8 cm. Leaf blade width less than 0.8 cm. Leaf margin entire, revolute. Leaf apex acute. Ochrea bifid-laciniate. Ochrea length 1–2.5 cm. Ochrea pink. Petiole 1 cm or less. Inflorescence axillary cluster. Flowers bisexual, sessile. Perianth segments 5, white. Perianth tube present. Stamens more than 6. Style and stigma three. Nutlet brownish, biconvex, dull. Nutlet surface smooth. Fruit wings absent.

***Polygonum patulum* M. Bieb.**

Plant perennial, herb. Average height 20–80 cm. Stem prostrate-decumbent, glabrous, branching from the base, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, sagittate. Leaf blade length 1–8 cm. Leaf blade width less than 0.8 cm. Leaf margin entire, flat. Leaf apex acute. Ochrea bifid-laciniate. Ochrea length less than 1 cm. Ochrea transparent. Petiole 1 cm or less. Inflorescence axillary cluster. Flowers bisexual, pedicelled. Perianth segments 5, white. Perianth tube absent. Stamens more than 6. Style and stigma one. Nutlet brownish, lenticular, shiny. Nutlet surface smooth. Fruit wings absent.

***Polygonum plebeium* R.Br.**

Plant annual, herb. Average height less than 20 cm. Stem prostrate-decumbent, glabrous, branching lateral, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, sagittate. Leaf blade length less than 1 cm. Leaf blade width less than 0.8 cm. Leaf margin entire, revolute. Leaf apex acute. Ochrea bifid-

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lacinate. Ochrea length less than 1 cm. Ochrea transparent. Petiole 1 cm or less. Inflorescence axillary cluster. Flowers bisexual, pedicelled. Perianth segments 5, pink. Perianth tube absent. Stamens 5. Style and stigma three. Nutlet black, trigonous, shiny. Nutlet surface smooth. Fruit wings absent.

Rumex bucephalophorus L.

Plant annual, herb. Average height less than 20 cm. Stem erect, glabrous, branching from the base, green-reddish brown, terete. Leaves simple, persistent, glabrous, asymmetrical, sagittate. Leaf blade length 1–8 cm. Leaf blade width 0.8–2 cm. Leaf margin entire, flat. Leaf apex obtuse. Ochrea connate. Ochrea length less than 1 cm. Ochrea transparent. Petiole 1 cm or less. Inflorescence spike. Flowers bisexual, pedicelled. Perianth segments 6, pink. Perianth tube absent. Stamens 6. Style and stigma three. Nutlet brownish, lenticular, shiny. Nutlet surface with stiff bristles. Fruit wings absent.

Rumex crispus L.

Plant annual, herb. Average height 20–80 cm. Stem erect, glabrous, branching from the base, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, sagittate. Leaf blade length more than 8 cm. Leaf blade width more than 2 cm. Leaf margin undulate, flat. Leaf apex acute. Ochrea connate. Ochrea length less than 1 cm. Ochrea transparent. Petiole more than 1 cm. Inflorescence spike. Flowers bisexual, pedicelled. Perianth segments 6, pink. Perianth tube absent. Stamens 6. Style and stigma three. Nutlet brownish, trigonous, shiny. Nutlet surface smooth. Fruit wings absent.

Rumex cyprius Murb.

Plant annual, herb. Average height less than 20 cm. Stem erect, glabrous, branching from the base, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, orbicular. Leaf blade length 1–8 cm. Leaf blade width more than 2 cm. Leaf margin entire, flat. Leaf apex acute. Ochrea connate. Ochrea length less than 1 cm. Ochrea transparent. Petiole more than 1 cm. Inflorescence axillary cluster. Flowers bisexual, pedicelled. Perianth segments 6, pink. Perianth tube absent. Stamens 6. Style and stigma three. Nutlet brownish, trigonous, shiny. Nutlet surface smooth. Fruit wings absent.

Rumex dentatus subsp. *dentatus* L.

Plant annual, herb. Average height more than 80 cm. Stem erect, glabrous, branching from the base, green-reddish brown, angled. Leaves simple, persistent, glabrous, symmetrical, sagittate. Leaf blade length 1–8 cm. Leaf blade width more than 2 cm. Leaf margin undulate, flat. Leaf apex obtuse. Ochrea bifid-lacinate.

Ochrea length more than 2.5 cm. Ochrea transparent. Petiole more than 1 cm. Inflorescence axillary cluster. Flowers bisexual, pedicelled. Perianth segments 6, white. Perianth tube absent. Stamens 6. Style and stigma three. Nutlet brownish, trigonous, shiny. Nutlet surface smooth. Fruit wings absent.

Rumex dentatus subsp. *mesopotamicus* Rech.f.

Plant annual, herb. Average height 20–80 cm. Stem erect, glabrous, branching from the base, green-reddish brown, angled. Leaves simple, persistent, glabrous, symmetrical, sagittate. Leaf blade length 1–8 cm. Leaf blade width more than 2 cm. Leaf margin undulate, flat. Leaf apex obtuse. Ochrea bifid-laciniate. Ochrea length more than 2.5 cm. Ochrea transparent. Petiole more than 1 cm. Inflorescence axillary cluster. Flowers bisexual, pedicelled. Perianth segments 6, white. Perianth tube absent. Stamens 6. Style and stigma three. Nutlet brownish, trigonous, shiny. Nutlet surface granulate. Fruit wings absent.

Rumex pictus Forssk.

Plant annual, herb. Average height less than 20 cm. Stem prostrate-decumbent, glabrous, branching from the base, green-reddish brown, terete. Leaves 5-lobed, persistent, glabrous, asymmetrical, and deltoid. Leaf blade length 1–8 cm. Leaf blade width more than 2 cm. Leaf margin undulate, flat. Leaf apex acute. Ochrea bifid-laciniate. Ochrea length more than 2.5 cm. Ochrea transparent. Petiole more than 1 cm. Inflorescence axillary cluster. Flowers unisexual, pedicelled. Perianth segments 6, pink. Perianth tube absent. Stamens 6. Style and stigma three. Nutlet brownish, trigonous, shiny. Nutlet surface smooth. Fruit wings present.

Rumex pulcher L.

Plant annual, herb. Average height 20–80 cm. Stem erect, glabrous, branching lateral, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, sagittate. Leaf blade length 1–8 cm. Leaf blade width 0.8–2 cm. Leaf margin entire, flat. Leaf apex acute. Ochrea connate. Ochrea length more than 2.5 cm. Ochrea transparent. Petiole 1 cm or less. Inflorescence raceme. Flowers bisexual, pedicelled. Perianth segments 6, pink. Perianth tube absent. Stamens 6. Style and stigma three. Nutlet brownish, trigonous, shiny. Nutlet surface smooth. Fruit wings present.

Rumex roseus L.

Plant annual, herb. Average height 20–80 cm. Stem erect, glabrous, branching from the base, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, orbicular. Leaf blade length 1–8 cm. Leaf blade width more than 2 cm. Leaf margin undulate, flat. Leaf apex obtuse. Ochrea connate. Ochrea length less

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than 1 cm. Ochrea transparent. Petiole more than 1 cm. Inflorescence spike. Flowers bisexual, pedicelled. Perianth segments 6, white. Perianth tube absent. Stamens 6. Style and stigma three. Nutlet brownish, trigonous, shiny. Nutlet surface smooth. Fruit wings present.

Rumex simpliciflorus Murb.

Plant annual, herb. Average height less than 20 cm. Stem erect, glabrous, branching from the base, green-reddish brown, terete. Leaves simple, persistent, glabrous, asymmetrical, and orbicular. Leaf blade length 1–8 cm. Leaf blade width more than 2 cm. Leaf margin entire, flat. Leaf apex obtuse. Ochrea connate. Ochrea length less than 1 cm. Ochrea transparent. Petiole more than 1 cm. Inflorescence spike. Flowers bisexual, pedicelled. Perianth segments 6, pink. Perianth tube absent. Stamens 6. Style and stigma three. Nutlet brownish, trigonous, shiny. Nutlet surface smooth. Fruit wings present.

Rumex vesicarius L.

Plant annual, herb. Average height less than 20 cm. Stem erect, glabrous, branching lateral, green-reddish brown, terete. Leaves simple, persistent, glabrous, symmetrical, and ovate. Leaf blade length 1–8 cm. Leaf blade width more than 2 cm. Leaf margin entire, flat. Leaf apex obtuse. Ochrea bifid-laciniate. Ochrea length less than 1 cm. Ochrea transparent. Petiole more than 1 cm. Inflorescence raceme. Flowers bisexual, pedicelled. Perianth segments 6, pink. Perianth tube absent. Stamens 6. Style and stigma three. Nutlet brownish, trigonous, shiny. Nutlet surface smooth. Fruit wings present.

4. Item descriptions

Atraphaxis spinosa L. var. *sinaica* (Jaub. & Spach) Boiss. /
1,2 2,2 3,2 4,1 5,3 6,1 7,1 8,2 9,1 10,1 11,1 12,1 13,1 14,1 15,1 16,1 17,1 18,1 19,1
20,1 21,2 22,1 23,1 24,2 25,2 26,1 27,1 28,2 29,2 30,2 31,1 32,2 33,1 34,2 35,2

Calligonum comosum L'Her. /
1,2 2,2 3,3 4,1 5,1 6,1 7,2 8,1 9,1 10,2 11,1 12,1 13,1 14,1 15,1 16,1 17,1 18,1 19,1
20,1 21,1 22,1 23,1 24,2 25,1 26,2 27,2 28,2 29,3 30,3 31,2 32,3 33,1 34,3 35,2

Emex spinosa (L.) Campd. /
1,1 2,1 3,2 4,2 5,1 6,2 7,2 8,1 9,1 10,1 11,1 12,1 13,2 14,1 15,1 16,2 17,1 18,2 19,2
20,1 21,1 22,1 23,1 24,1 25,2 26,3 27,1 28,2 29,2 30,3 31,3 32,1 33,1 34,3 35,2

Fallopia convolvulus (L.) A. Löve /
1,1 2,1 3,3 4,3 5,1 6,1 7,2 8,2 9,1 10,1 11,1 12,1 13,3 14,1 15,1 16,1 17,1 18,3 19,2
20,1 21,2 22,2 23,2 24,2 25,1 26,2 27,2 28,2 29,3 30,3 31,4 32,1 33,2 34,1 35,2

\b{i}{Oxygonum atriplicifolium \i0{}}(Meisn.) Martelli\b0{}/
 1,1 2,1 3,2 4,2 5,1 6,2 7,2 8,1 9,2 10,1 11,1 12,1 13,2 14,2 15,2 16,1 17,1 18,2 19,2
 20,1 21,1 22,2 23,2 24,2 25,1 26,3 27,3 28,1 29,3 30,3 31,2 32,1 33,1 34,2 35,2

\b{i}{Oxygonum sinuatum \i0{}}(Hochst. & Steud. ex Meisn.) Dammer\b0{}/
 1,1 2,1 3,1 4,2 5,1 6,2 7,2 8,1 9,2 10,1 11,1 12,1 13,2 14,2 15,2 16,1 17,1 18,2 19,2
 20,1 21,1 22,2 23,2 24,2 25,1 26,3 27,3 28,2 29,3 30,3 31,2 32,1 33,1 34,2 35,2

\b{i}{Persicaria decipiens \i0{}}(R.Br.) K.L. Wilson\b0{}/
 1,2 2,1 3,2 4,1 5,1 6,1 7,2 8,1 9,1 10,1 11,1 12,1 13,4 14,3 15,2 16,1 17,1 18,2 19,2
 20,2 21,1 22,1 23,3 24,2 25,1 26,2 27,1 28,2 29,1 30,3 31,4 32,2 33,1 34,2 35,2

\b{i}{Persicaria lanigera \i0{}}(R.Br.) Sojak\b0{}/
 1,2 2,1 3,2 4,1 5,2 6,1 7,2 8,1 9,1 10,1 11,2 12,1 13,1 14,3 15,3 16,1 17,1 18,3 19,2
 20,2 21,1 22,2 23,2 24,2 25,2 26,2 27,1 28,2 29,2 30,2 31,4 32,1 33,1 34,2 35,2

\b{i}{Persicaria lapathifolia \i0{}}(L.) Delarbre\b0{}/
 1,1 2,1 3,2 4,1 5,1 6,1 7,2 8,1 9,1 10,1 11,1 12,1 13,4 14,3 15,3 16,1 17,1 18,2 19,2
 20,2 21,1 22,1 23,3 24,2 25,2 26,1 27,1 28,2 29,2 30,2 31,4 32,1 33,1 34,2 35,2

\b{i}{Persicaria senegalensis \i0{}}(Meisn.) Sojak\b0{}/
 1,2 2,1 3,3 4,1 5,1 6,1 7,2 8,1 9,1 10,1 11,2 12,1 13,4 14,3 15,3 16,2 17,1 18,3 19,2
 20,3 21,2 22,2 23,3 24,2 25,1 26,2 27,1 28,1 29,3 30,2 31,4 32,1 33,2 34,2 35,2

\b{i}{Polygonum aviculare \i0{}}L.\b0{}/
 1,1 2,1 3,2 4,2 5,1 6,2 7,2 8,1 9,1 10,1 11,1 12,1 13,4 14,2 15,2 16,1 17,1 18,2 19,2
 20,1 21,1 22,1 23,1 24,2 25,1 26,2 27,2 28,2 29,3 30,1 31,1 32,1 33,2 34,2 35,2

\b{i}{Polygonum bellardii \i0{}}All.\i{} \b0{i0{}}/
 1,1 2,1 3,1 4,1 5,1 6,1 7,2 8,1 9,1 10,1 11,1 12,1 13,4 14,2 15,1 16,1 17,1 18,2 19,2
 20,1 21,1 22,1 23,1 24,2 25,2 26,2 27,1 28,2 29,2 30,1 31,4 32,1 33,2 34,2 35,2

\b{i}{Polygonum equisetiforme \i0{}}Sm.\b0{}/
 1,2 2,1 3,3 4,2 5,1 6,1 7,2 8,1 9,1 10,2 11,1 12,1 13,4 14,2 15,2 16,1 17,1 18,2 19,1
 20,1 21,2 22,1 23,3 24,2 25,1 26,2 27,1 28,2 29,3 30,1 31,1 32,3 33,1 34,2 35,2

\b{i}{Polygonum maritimum \i0{}}L.\b0{}/
 1,2 2,1 3,1 4,2 5,1 6,1 7,2 8,1 9,1 10,1 11,1 12,1 13,1 14,2 15,1 16,1 17,2 18,2 19,1
 20,2 21,2 22,1 23,1 24,2 25,2 26,2 27,3 28,1 29,3 30,3 31,1 32,4 33,2 34,2 35,2

\b{i}{Polygonum patulum \i0{}}M. Bieb.\b0{}/
 1,2 2,1 3,2 4,2 5,1 6,2 7,2 8,1 9,1 10,1 11,1 12,1 13,4 14,2 15,1 16,1 17,1 18,2 19,1
 20,1 21,1 22,1 23,1 24,2 25,1 26,2 27,3 28,2 29,3 30,1 31,1 32,3 33,1 34,2 35,2

\b{i}{Polygonum plebeium \i0{}} R.Br.\b0{}/
 1,1 2,1 3,1 4,2 5,1 6,1 7,2 8,1 9,1 10,1 11,1 12,1 13,4 14,1 15,1 16,1 17,2 18,2 19,1
 20,1 21,1 22,1 23,1 24,2 25,1 26,2 27,1 28,2 29,1 30,3 31,4 32,1 33,1 34,2 35,2

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\b{i}{Rumex bucephalophorus \i0{}L.\b0{}/

1,1 2,1 3,1 4,1 5,1 6,2 7,2 8,1 9,1 10,1 11,1 12,2 13,4 14,2 15,2 16,1 17,1 18,1 19,2
20,1 21,1 22,1 23,2 24,2 25,1 26,3 27,1 28,2 29,2 30,3 31,1 32,3 33,1 34,3 35,2

\b{i}{Rumex crispus \i0{}L.\b0{}/

1,1 2,1 3,2 4,1 5,1 6,2 7,2 8,1 9,1 10,1 11,1 12,1 13,4 14,3 15,3 16,2 17,1 18,2 19,2
20,1 21,1 22,2 23,2 24,2 25,1 26,3 27,1 28,2 29,2 30,3 31,1 32,1 33,1 34,2 35,2

\b{i}{Rumex cyprius \i0{} Murb.\b0{}/

1,1 2,1 3,1 4,1 5,1 6,2 7,2 8,1 9,1 10,1 11,1 12,1 13,1 14,2 15,3 16,1 17,1 18,2 19,2
20,1 21,1 22,2 23,1 24,2 25,1 26,3 27,1 28,2 29,2 30,3 31,1 32,1 33,1 34,2 35,2

\b{i}{Rumex dentatus \i0{}L\b0{}}subsp.\{ }dentatus\i0{}/

1,1 2,1 3,3 4,1 5,1 6,2 7,2 8,2 9,1 10,1 11,1 12,1 13,4 14,2 15,3 16,2 17,1 18,1 19,1
20,3 21,1 22,2 23,1 24,2 25,1 26,3 27,3 28,2 29,2 30,3 31,1 32,1 33,1 34,2 35,2

\b{i}{Rumex dentatus \i0{}subsp. \i{ }mesopotamicus \i0{}Rech.\i{ }f.\b0{i0{}/

1,1 2,1 3,2 4,1 5,1 6,2 7,2 8,2 9,1 10,1 11,1 12,1 13,4 14,2 15,3 16,2 17,1 18,1 19,1
20,3 21,1 22,2 23,1 24,2 25,1 26,3 27,3 28,2 29,2 30,3 31,1 32,1 33,1 34,1 35,2

\b{i}{Rumex pictus \i0{}Forssk.\b0{}/

1,1 2,1 3,1 4,2 5,1 6,2 7,2 8,1 9,2 10,1 11,1 12,2 13,3 14,2 15,3 16,2 17,1 18,2 19,1
20,3 21,1 22,2 23,1 24,1 25,1 26,3 27,1 28,2 29,2 30,3 31,1 32,1 33,1 34,2 35,1

\b{i}{Rumex pulcher \i0{}L.\b0{}/

1,1 2,1 3,2 4,1 5,1 6,1 7,2 8,1 9,1 10,1 11,1 12,1 13,4 14,2 15,2 16,1 17,1 18,2 19,2
20,3 21,1 22,1 23,3 24,2 25,1 26,3 27,1 28,2 29,2 30,3 31,1 32,1 33,1 34,2 35,1

\b{i}{Rumex roseus \i0{}L.\b0{}/

1,1 2,1 3,2 4,1 5,1 6,2 7,2 8,1 9,1 10,1 11,1 12,1 13,1 14,2 15,3 16,2 17,1 18,1 19,2
20,1 21,1 22,2 23,2 24,2 25,1 26,3 27,3 28,2 29,2 30,3 31,1 32,1 33,1 34,2 35,1

\b{i}{Rumex simpliciflorus \i0{}Murb.\b0{}/

1,1 2,1 3,1 4,1 5,1 6,2 7,2 8,1 9,1 10,1 11,1 12,2 13,1 14,2 15,3 16,1 17,1 18,1 19,2
20,1 21,1 22,2 23,2 24,2 25,1 26,3 27,1 28,2 29,2 30,3 31,1 32,1 33,1 34,2 35,1

\b{i}{Rumex vesicarius \i0{}L.\b0{}/

1,1 2,1 3,1 4,1 5,1 6,1 7,2 8,1 9,1 10,1 11,1 12,1 13,2 14,2 15,3 16,1 17,1 18,1 19,1
20,1 21,1 22,2 23,3 24,2 25,1 26,3 27,1 28,2 29,2 30,3 31,1 32,1 33,1 34,2 35,1

Discussion

The present work is one of a series of similar studies aiming to improve the quality of the keys used in the identification of members of the families represented by some genera and species in the flora of Egypt. References to all previous studies in this series are given by El-Gazzar et al. (2019 & 2020).

The present computer-generated key is a marked improvement over its predecessors in a variety of ways: (i) it is based on a significantly broader range of vegetative and floral morphological characteristics despite deliberately avoiding such characters that might necessitate the use of laborious and time-consuming techniques; (ii) the strictly accurate correspondence between characters in the key and those in the detailed descriptions of taxa guarantees the total absence of discrepancies between them which are sometimes met with in manually constructed keys and the descriptions associated with them; (iii) unlike previous keys which require complete restructuring to accommodate additional taxa, it is highly flexible and can be easily expanded to incorporate additional taxa/and or characters that may become available in the future; (iv) the latter advantage is particularly useful because it allows for easy placement of any of the three species reported by Boulos (1999, 2009) and for which no material could be found in local herbaria, (v) all 35 characters are included in the detailed description of every taxon, thus serving the all-important function of confirming the identity of these taxa.

The prelude to the key is an integral part of the outcome of the numerical analysis. It shows that only 14 of the 35 characters recorded for the studied taxa were sufficient to complete the process of key generation, thus indicating that the original data matrix contained a surplus of 21 characters which would be applied by the user of the key to ensure the identity of unknown specimen (s). Furthermore, the number of characters leading to the name of any taxon is consistently much fewer than 14. For example, the name of *Atraphaxis spinosa* L. var. *sinaica* (Jaub. et Spach) Boiss. is reachable with the greatest of ease through only two of the 35 recorded characters, thus leaving no less than 33 confirmatory characters in its detailed description. The same applies also to the names of *Calligonum comosum* L'Hér. or *Polygonum maritimum* L. as can be seen in the following excerpt of the key:

- | | | |
|-------|-------------------------|---|
| 1. | Leaves orbicular..... | 2 |
| | Leaves ovate | 5 |
| | Leaves deltoid..... | 7 |
| | Leaves sagittate..... | 8 |
| 2(1). | Nutlet trigonous | 3 |
| | Nutlet oblong | <i>Atraphaxis spinosa</i> var. <i>sinaica</i> |
| | Nutlet lenticular | <i>Calligonum comosum</i> |
| | Nutlet biconvex..... | <i>Polygonum maritimum</i> |

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- 3(2). Leaf apex obtuse 4
 Leaf apex acute *Rumex cyprius*
 Leaf apex acuminate *Persicaria lanigera*
- 4(3). Average height less than 20 cm; leaves asymmetrical; leaf margin entire;
 perianth segments
 pink..... *Rumex simpliciflorus*
 Average height 20-80 cm; leaves symmetrical; leaf margin undulate;
 perianth segments
 white..... *Rumex roseus*

It is also evident from the same excerpt that the maximum number of characters leading to the names of *Rumex simpliciflorus* Murb. and *R. roseus* L. is seven. The same maximum number of characters is required for the identification of eight other species (*Rumex pictus* Forssk., *R. pulcher* L., *R. bucephalophorus* L., *R. crispus* L., *Fallopia convolvulus* (L.) A. Löve, *Polygonum aviculare* L., *P. equisetiforme* Sm., and *Persicaria lapathifolia* (L.) Delarbre. There are 28 confirmatory characters in the detailed description of each of the ten species.

Table 1. Collection data of the herbarium specimens representing eight genera and 26 taxa of the Polygonaceae in the flora of Egypt. (Genera and species are in alphabetical order)

Taxa	Voucher details
1. <i>Atraphaxis spinosa</i> L. var. <i>sinaica</i> (Jaub. & Spach) Boiss.	*Sinai, on the step way to Gebel Mousa, 10/9/1956, N. El Hadidi (CAI). *Sinai, Saint Catherine, Wadi El Arbaein, 21/4/1983, N. El Hadidi et al., (CAI).
2. <i>Calligonum comosum</i> L'Hér.	*Alexandria Desert road, 4-7 km from Pyramids, 5/12/1952, L. Boulos, (CAIM). *Assiut, Wadi Assiuit, 4/4/1964, Zahran & Girgis (CAI) *Qena, Wadi Qena, 4/4/1982, A.A. Fayed & H. Hosni (CAI).
3. <i>Emex spinosa</i> (L.) Campd.	*In the fields around Kingi-Mariut, 7/4/1967, V. Täckholm, (CAI). *Burg al Arab, 23/9/1971, Imam, Ibrahim, Mahdi & S. Sisi, (CAI). *Alexandria Provinces, 26/4/1987, A. Amer 10507, (CAI)
4. <i>Fallopia convolvulus</i> (L.) Á. Löve	*Rosetta, in grassy fields, 23/6/1974, Imam & Mahdi, (CAI)

5. <i>Oxygonum atriplicifolium</i> (Meisn.) Martelli	*Gebel Elba in the S.E. corner of Egypt, 14/2/1933, the excursion of the botanical department, Fahmy & Hassib (CAI).
6. <i>Oxygonum sinuatum</i> (Hochst. & Steud ex Meisn.) Dammer	*Gebel Elba in the S.E. corner of Egypt, 23/1/1929, the excursion of the botanical department, G. Täckholm, (CAI)
7. <i>Persicaria decipiens</i> (R.Br.) K.L.Wilson	*Gebel Elba, 11//12/1965, V. Täckholm (CAIM). *El Hamul near Baltim, 25/9/1970, Imam & Mahdi (CAI).
8. <i>Persicaria lanigera</i> (R.Br.) Soják	*Aswan, 23/12/1967, A. Kassas et al. (CAI).
9. <i>Persicaria lapathifolia</i> (L.) Delarbre	*Between Ashmoun and Sentris, 20/10/1967, V. Täckholm, Imam & N. El Hadidi, (CAI). *Rosetta, El Hammad, Masraf el Gedid, 23/9/1971, Imam, Ibrahim, Mahdi & Sisi (CAI).
10. <i>Persicaria senegalensis</i> (Meisn.) Soják	*On the way to Bilbeis along Isamailia Canal, 27/3/1968, V. Täckholm (CAIM). * Rosetta, El Hamad, 19/8/1971, Imam, Ibrahim & Mahdi (CAI) *Damietta, El Sirrw, 30/8/1971, L. Boulos, Imam, Ibrahim & S. Sisi (CAIM).
11. <i>Polygonum aviculare</i> L.	*Between Qurna and Chibayish, 23/1/1973, M. Al Hilli (CAI).
12. <i>Polygonum bellardii</i> All.	*Faiyum, 18/5/1975, A. Amin & Abdel Aziz (CAI).
13. <i>Polygonum equisetiforme</i> Sm.	*Shibin el Qanatir, 22/6/1973, Ibrahim, Mahdi, S. Sisi & Abdel Alziz (CAI). *166 km from Cairo on the desert road to Alexandria, 7/7/1976, A. Amin, Abdel Aziz & S. el Sisi (CAI).
14. <i>Polygonum maritimum</i> L.	*Al Saloom, in sand, 22/11/1966, L. Boulos (CAIM).
15. <i>Polygonum patulum</i> M. Bieb.	*Dakhla Oasis, 2/5/1969, Osborn & I. Helmy (CAI). *Bahariya Oasis, 12/9/1971, Imam (CAI). * Giza, Tahrir Province, 8/6/1973, Ibrahim, Mahdi, S. Sisi & Abdel Aziz (CAI).
16. <i>Polygonum plebeium</i> R.Br.	*Cairo, fields at Manyal al rodah east bank of Nile, 7/1/1952, N. El Hadidi (CAIM).

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	<p>*Helwan Farouk's rest house, 6/4/1953, L. Boulos (CAI).</p> <p>* El Minia, 15/10/1971, L. Boulos, Imam, Mahdi (CAI).</p>
17. <i>Rumex bucephalophorus</i> L.	<p>*Sinai, Rafah near the station, 22/3/1928, G. Täckholm (CAI).</p> <p>*West desert, 13/3/1968, L. Boulos (CAI).</p>
18. <i>Rumex crispus</i> L.	*Qalubya, Arab El Haswa, 18/6/1983, H. El Fayoumi (CAI).
19. <i>Rumex cyprius</i> Murb.	<p>* Suez, Wadi Amloug, 60 km south of Suez, 26/2/1964, A. Kassas (CAI).</p> <p>* Suez, 3 km in wadi Hagoul, 27/3/1983, H. El Fayoumi (CAI).</p>
20. <i>Rumex dentatus</i> L. subsp. <i>dentatus</i>	<p>*Mariut, Masraf Khorshid Rice fields, 28/8/1928, M.A. Mustafa & Sabet (CAI)</p> <p>*Barrage, 2/4/1954, A. Abdel Fadeel (CAI)</p> <p>* Giza, south Tahrir, Beni Salama, 26/3/1987, A. Soliman (CAI)</p>
21. <i>Rumex dentatus</i> subsp. <i>mesopotamicus</i> Rech. f.	*East desert, 20/10/1956, Rechinger & N. El Hadidi (CAI).
22. <i>Rumex pictus</i> Forssk.	<p>*Rosetta, 20/4/1973, Ibrahim, Mahdi & Sisi (CAI).</p> <p>*El Maadia on the road Alexandria-Rosetta, 26/3/1974, V. Täckholm, N. El Hadidi, Ayyad, Mahdi & Abdel Aziz (CAI).</p> <p>*Rosetta, 10/3/1978, Imam & Soliman (CAIM)</p>
23. <i>Rumex pulcher</i> L.	*Beheira province, El Dilingat, 21/3/1987, A. Amer 10034 (CAI).
24. <i>Rumex roseus</i> L.	*Suez, Gebel Ataqa, wadi Abar, 15/2/1956, V. Täckholm (CAIM).
25. <i>Rumex simpliciflorus</i> Murb.	*Gebel Elba, Khor wadi Yahameib, 22/1/1962, V. Täckholm, Kassas, Fawzy (CAI).
26. <i>Rumex vesicarius</i> L.	<p>*Sinai, Wadi Gharandal, Sait. Cathrine, 23/4/1983, N. El Hadidi et al. (CAI).</p> <p>*Cairo-Suez road, 12/4/2012, M. Abdel Aleem (CAI)</p>

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