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Computer-generated keys to the flora of Egypt. 12. The Euphorbiaceae s.l.

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Representatives of the Euphorbiaceae s.l. in the flora of Egypt are notoriously difficult to identify with any degree of certainty, especially when using the manually constructed keys currently available for them. Such keys are based largely on single characters separating alternative entries of the same couplet which may vary considerably in individual plants of the same species. To benefit from the versatility and advantages of computer programs designed for key construction, two data matrices were constructed to accommodate comparative variation in the features of vegetative and floral morphology of three succulent *Euphorbia* species and 45 non-succulent species of the eight genera representing the Euphorbiaceae s.s. and the Phyllanthaceae in the flora of Egypt. Each matrix was subjected to analysis using the DELTA package of computer programs to generate a key to the species, accompanied by detailed and item descriptions of individual species in terms of the recorded characters for confirmation of the results obtained by the user. Both keys are a marked improvement over their previous manually constructed counterparts.

Keywords: DELTA, Euphorbiaceae s.s., identification, key, non-succulents, Phyllanthaceae, succulents

INTRODUCTION

The Euphorbiaceae s.l. was divided in the phylogenetic classification accepted by the Angiosperm Phylogeny Group (APG IV, 2016) into seven distinct families: Euphorbiaceae s.s. (= Euphorbiaceae Juss., in a restricted sense), Phyllanthaceae Martynov, Pandaceae Engl. & Gilg, Picrodendraceae Small., Peraceae Klotzsch, Putranjivaceae Endl. ex Meisn., and Centroplacaceae Doweld & Reveal. Only the first two of these families are represented by some genera and species in the flora of Egypt. For purposes of the present study, representatives of both families are treated under the collective name of Euphorbiaceae s.l. without classificatory connotations.

According to Boulos (2000), the genera representing the Euphorbiaceae s.s. are *Euphorbia* (41 spp. with 2 varieties), *Jatropha* (1 sp.), *Ricinus* (1 sp.), *Mercurialis* (1 sp.), and *Chrozophora* (4 spp.), while the Phyllanthaceae are represented by *Andrachne* (2 spp.), *Fluggea* (1 sp.), and *Phyllanthus* (4 spp. with 2 varieties), making a total of eight genera and 55 species with four varieties. Subsequently, El-Karemy (1994) added *Euphorbia schimperii* and *E. terracina* var. *modesta*. Several keys to the genera and species of the Euphorbiaceae s.l. and their type of genus *Euphorbia* in Egypt were provided by Muschler (1912), Ramis (1929), Montasir & Hassib (1956),

Täckholm (1956 and 1974), El Hadidi (1973), El Hadidi & Fayed (1978), Fayed (1973, 1977), Fayed & Hassan (2005) and Fayed *et al.* (2019). While some of these keys are relatively more efficient than others, they were collectively constructed manually and share some pitfalls and contradictions. For instance, characters leading to the name of a genus and its species in the key may differ with those in the detailed description of the same genus or species. Furthermore, it is not infrequent to find that one entry in a couplet is defined by the state of a character, while its alternative entry is diagnosed by the state of another character. The choice of characters for key construction may be confusing to the user of such conventional keys because the states of these characters may vary considerably between individual plants of the same species. With the advent of packages of computer programs designed specifically for the generation of identification keys free of such contradictions, it became highly desirable to replace the manually constructed keys with their computer-generated counterparts. Previous attempts to benefit from the advantages of the DELTA program package (Dallwitz, 1993, 2010; Dallwitz & Paine, 2005; Dallwitz *et al.*, 1993) showed that the resulting keys are by far superior to their predecessors; for some previous articles in this series, reference can be made to El-Gazzar, *et al.* (2019; 2022; 2023).

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MATERIALS AND METHODS

Herbarium specimens of 48 species belonging to the eight genera of Euphorbiaceae s.l. in Egypt were obtained from the Cairo University Herbarium (CAI) and supplemented with fresh collections from various parts of the country. Only a list of the species kept in the herbarium of the Flora and Phyto-taxonomy Unit in the Agricultural Museum, Giza (CAIM) was available. At least five specimens of every taxon were examined for morphological variation in vegetative and floral parts and the characters were defined so that the states of each character are widely distinct from each other. The glossary of botanical terms by Stearn (2004) was used in defining the characters and their states to ensure unambiguous interpretations of the terms used. Identification of all taxa was re-affirmed with the help of keys and descriptions provided by El Hadidi and Fayed (1978) and Boulos (2000); nomenclature of the species was updated according to WFO (2022).

Cursory inspection of available specimens showed that foliar morphology is the richest source of variation between different taxa. In three succulent *Euphorbia* spp. the leaves are either caducous or modified into short spines. In recording the aspects of variation comparatively in a data matrix, all foliar features will be unavoidably inapplicable to those of the succulent taxa. and their characters will be unavoidably inapplicable to the leaves of the 45 non-succulent species. Therefore, the 48 taxa were divided into two groups: succulents (3 *Euphorbia* spp.), and non-succulents (45 species representing eight genera). A separate data matrix was prepared for each group prior to being subjected to analysis using the DELTA program package (Dallwitz, 1993, 2010; Dallwitz & Paine, 2005; Dallwitz *et al.*, 1993) to generate a separate key for each group.

RESULTS

The species range from small annual, erect, or scrambling herbs growing as weeds in the agroecosystem throughout Egypt, to stiff perennial shrubs and succulent xerophytes inhabiting arid and semi-arid localities in desert expanses, mountain slopes and calcareous wadi beds. Stems of the succulent species may be smooth and cylindrical carrying broad caducous foliage leaves or angled with the leaves modified into short bifurcate spines. Milky latex is copious in members of the Euphorbiaceae s.s. (except *Ricinus communis*), and watery or absent in representatives of the Phyllanthaceae. Partial

inflorescences in the Euphorbiaceae s.s. are consistently cyathia arranged in simple or compound umbels which may be terminal or axillary. In the Phyllanthaceae, the inflorescence is mostly a simple spike or raceme. Leaf blades are commonly simple but shallowly 3-lobed in *some Chrozopora* species and deeply 7-(9)-lobed with dentate margins in *Ricinus communis*. Blade outline varies widely from narrowly linear (e.g., in *Euphorbia mauritanica*, *E. arabica*) to sub-orbicular (e.g., in *Andrachne aspera*, *A. telepioides*, *Flueggia virosa*), with intermediate ovate, obovate, elliptical-rhombic, lanceolate, and oblanceolate-spatheolate shapes. Fruit and seed shape and surface color and texture were a rich source of useful variation in the plants' characters.

Recording the aspects of variation in available specimens of both families in a comparative fashion necessitated separation of the species into two groups: succulents and non-succulents because the richest source of this variation in the Euphorbiaceae s.l. comes from foliar morphology, and it will evidently become inapplicable to the three succulent species with the leaves reduced into short, sharp bifurcate spines. Each group of species has its own list of species, list of characters with their character-states, and hence its own key, and item and detailed descriptions.

Succulents

Character List

- #1. Plant/ 1. annual/ 2. perennial/
- #2. Plant/ 1. erect/ 2. prostrate/
- #3. Plant/ 1. succulent shrub/ 2. herb/
- #4. Stem/ 1. terete/ 2. angular/
- #5. Milky latex/ 1. copious/ 2. absent/
- #6. Leaf scars/ 1. conspicuous/ 2. absent/
- #7. Leaves/ 1. modified into bifurcate spines/ 2. not modified into bifurcate spines/
- #8. Leaves/ 1. caducous/ 2. persistent/
- #9. Cyathia in/ 1. terminal umbels/ 2. terminal spikes/
- #10. Cyathia/ 1. subtended by bracts/ 2. ebracteate/
- #11. Ovary/ 1. exerted/ 2. not exerted/
- #12. Seeds/ 1. grey/ 2. brown to black/
- #13. Leaf length/cm/

The Key

Characters: 13 in data, 12 included, 6 in key.

Items: 3 in data, 3 included, 3 in key.

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

Characters included: 1–12

Character reliabilities: 1–13,5,0

1. Stem terete; leaves not modified into bifurcate spines; leaves caducous

2

- Stem angular; leaves modified into bifurcate spines; leaves persistent *Euphorbia polyacantha*
 2(1). Leaf scars conspicuous; ovary exerted; seeds brown-black *Euphorbia mauritanica*
 Leaf scars absent; ovary not exerted; seeds grey *Euphorbia nubica*

Detailed descriptions

Euphorbia mauritanica L.

Plant perennial. Plant erects. Plant succulent shrub. Stem terete. Milky latex copious. Leaf scars conspicuous. Leaves not modified into bifurcate spines. Leaves caducous. Cyathia in terminal spikes. Cyathia ebracteate. Ovary exerted. Seeds brown-black. Leaf length 1–1.5 cm.

Euphorbia nubica N.E. Br.

Plant perennial. Plant erects. Plant succulent shrub. Stem terete. Milky latex copious. Leaf scars absent. Leaves not modified into bifurcate spines. Leaves caducous. Cyathia in terminal spikes. Cyathia ebracteate. Ovary not exerted. Seeds grey. Leaf length 1–2.5 cm.

Euphorbia polyacantha Boiss.

Plant perennial. Plant erects. Plant succulent shrub. Stem angular. Milky latex copious. Leaf scars absent. Leaves modified into bifurcate spines. Leaves persistent. Cyathia in terminal spikes. Cyathia ebracteate. Ovary not exerted. Seeds grey. Leaf length 1–1.5 cm.

Item Descriptions

```
# \b{i}Euphorbia mauritanica \i{L.}\b{0}/
1,2 2,1 3,1 4,1 5,1 6,1 7,2 8,1 9,2 10,2 11,1 12,2 13,1-1.5
# \b{i}Euphorbia nubica \i{N.E. Br.}\b{0}/
1,2 2,1 3,1 4,1 5,1 6,2 7,2 8,1 9,2 10,2 11,2 12,1 13,1-2.5
# \b{i}Euphorbia polyacantha \i{Boiss.}\b{0}/
1,2 2,1 3,1 4,2 5,1 6,2 7,1 8,2 9,2 10,2 11,2 12,1 13,1-1.5
```

Non-succulents

The List of Characters

- #1. plant/1. annual/ 2. perennial/
 #2. plant/1. shrub/ 2. herb/
 #3. plant/1. erect/ 2. prostrate/
 #4. plant/1. glabrous/ 2. tomentose/ 3. hirsute/
 #5. milky latex/1. present/ 2. absent/
 #6. stem branching/1. at the base/ 2. above the base/
 #7. lateral branches/1. ending in a spine/ 2. not ending in a spine/
 #8. glands on petiole/1. present/ 2. absent/
 #9. petiole-blade attachment/1. basal/ 2. peltate/
 #10. midrib/1. prominent/ 2. not prominent/
 #11. leaves/1. simple/ 2. 3-lobed/ 3. 5-lobed/ 4. 7 or more lobed/
 #12. leaves/1. sessile/ 2. subsessile/ 3. petioled/
 #13. leaves/1. alternate/ 2. opposite/
 #14. leaves/1. overlapped/ 2. distanced/
 #15. leaves/1. ovate/ 2. obovate/ 3. elliptical-rhombic/ 4. linear-lanceolate/ 5. oblanceolate-spatheolate/ 6. suborbicular/

- #16. sides of leaf blade/1. equal/ 2. unequal/
 #17. leaf apex/1. acute-acuminate/ 2. rotundate/ 3. mucronate/
 #18. leaf margin/1. entire/ 2. dentate-serrate/ 3. sinuate/
 #19. base of blade/1. symmetrical/ 2. asymmetrical/
 #20. base of blade/1. acute-cuneate/ 2. rotundate/ 3. cordate/
 #21. blade length/1. 4-9 mm/ 2. 12-20 mm/ 3. 25-70 mm/ 4. 120 mm or more/
 #22. blade width/1. 2-10 mm/ 2. 22-32 mm/ 3. 50-60 mm/ 4. 130 mm or more/
 #23. blade length/width ratio/
 #24. inflorescence/1. axillary/ 2. terminal/
 #25. inflorescence/1. raceme/ 2. cymose/ 3. umbel/ 4. spike/
 #26. cyathium/1. monoecious/ 2. dioecious/
 #27. female flowers/1. one/ 2. more than one/
 #28. petals/1. five/ 2. absent/
 #29. staminal filaments/1. free/ 2. united in bundles/
 #30. fruit/1. capsule/ 2. drupe/
 #31. locules/1. two/ 2. three/ 3. four or more/
 #32. fruit length/ mm/
 #33. fruit/1. with hairs on ribs/ 2. with hairs on surface/ 3. glabrous/
 #34. fruit surface/1. warty/ 2. not warty/
 #35. seeds per locule/1. one/ 2. two/
 #36. seed length/ mm/
 #37. seeds/1. brown-black/ 2. white or grey/ 3. variegated/
 #38. seeds/1. with shallow depressions/ 2. without shallow depressions/
 #39. caruncle/1. present/ 2. absent/*Key 5. Confirmatory characters

The Key

There follows an unedited version of the key to the non-succulent genera and species representing the Euphorbiaceae s.s. and Phyllanthaceae in the flora of Egypt. It is preceded by a prelude defining the parameters used in key generation, including the number of characters recorded (39 indata), used in comparisons (36 included quantitative characters 23, 32 and 38 were masked), and featuring in the key (22 in key). It also shows that none of the 49 items (taxa) was masked in the computer run. Characters reliabilities are variable from 1 to 10, and the default value of 5 was applied equally to all 39 characters.

Characters: 39 indata, 36 included, 22 in key.

Items: 49 in data, 49 included, 49 in key.

Parameters: Rbase = 1.40 Abase = 2.00 Reuse = 1.01

Varywt = .80

Characters included: 1–22 24–31 33–35 37–39

Character reliabilities: 1–39,5.0

- | | | |
|-------|---------------------------------|---------------------------|
| 1. | Leaves ovate | 2 |
| | Leaves obovate | 12 |
| | Leaves elliptical-rhombic | 17 |
| | Leaves linear-lanceolate | 21 |
| | Leaves oblanceolate-spatheolate | 30 |
| | Leaves suborbicular | 33 |
| 2(1). | Inflorescence raceme | 3 |
| | Inflorescence cymose | 8 |
| | Inflorescence umbel | <i>Euphorbia punctata</i> |
| | Inflorescence spike | <i>Mercurialis annua</i> |
| 3(2). | Plant glabrous | 4 |
| | Plant tomentose | 5 |
| | Plant hirsute | 6 |

- 4(3). Leaves alternate; leaves distanced; plant perennial; leaf margin entire *Andrachne telephioides* 28
Leaves opposite; leaves overlapped; plant annual; leaf margin dentate-serrate *Euphorbia peplis* 29
- 5(3). Leaves simple; leaves subsessile; leaves opposite; leaves distanced *Euphorbia scordifolia* 23
Leaves 3-lobed; leaves petioled; leaves alternate; leaves overlapped *Chrozophora brocchiana* 24
- 6(3). Fruit with hairs on ribs *Euphorbia prostrata* 25
Fruit with hairs on surface *Euphorbia hypericifolia* 26
Fruit glabrous 7
- 7(6). Leaves overlapped; blade length 4-9 mm; base of blade asymmetrical; plant prostrate *Euphorbia chmaesyce* 25
Leaves distanced; blade length 12-20 mm; base of blade symmetrical; plant erect *Euphorbia indica* 26
- 8(2). Plant glabrous 9
Plant tomentose *Euphorbia petiolata* 11
Plant hirsute 11
- 9(8). Leaf apex acute-acuminate; leaf margin dentate-serrate; base of blade acute-cuneate; blade length 12-20 mm *Euphorbia hyssopifolia* 10
Leaf apex rotundate; leaf margin entire; base of blade cordate; blade length 4-9 mm 10
- 10(9). Stem branching at the base; seeds with shallow depressions *Euphorbia inaequilatera* var. *inaequilatera* 10
Stem branching above the base; seeds without shallow depressions *Euphorbia serpens* 11
- 11(8). Leaves subsessile; leaves opposite; leaves distanced; blade width 2-10 mm *Euphorbia hirta* 13
Leaves petioled; leaves alternate; leaves overlapped; blade width 22-32 mm *Euphorbia heterophylla* 15
Blade length 4-9 mm 13
Blade length 12-20 mm 15
Blade length 25-70 mm *Flueggia virosa* 15
- 13(12). Plant glabrous; base of blade acute-cuneate; staminal filaments united in bundles *Phyllanthus rotundifolius* 14
Plant hirsute; base of blade rotundate; staminal filaments free 14
- 14(13). Leaves alternate; plant perennial; leaf apex mucronate; base of blade symmetrical *Phyllanthus nummulariifolia* 14
Leaves opposite; plant annual; leaf apex rotundate; base of blade asymmetrical *Euphorbia granulata* 14
- 15(12). Leaves subsessile; leaves alternate; leaves distanced; plant perennial 16
Leaves petioled; leaves opposite; leaves overlapped plant annual *Euphorbia peplus* 16
- 16(15). Leaf apex rotundate; fruit glabrous; fruit surface warty *Euphorbia hierosolymitana* 16
Leaf apex mucronate; fruit with hairs on surface; fruit surface not warty *Euphorbia bivonae* 16
- 17(1). Leaves sessile 18
Leaves subsessile 19
Leaves petioled 20
- 18(17). Leaves alternate; leaves overlapped; plant perennial; blade length 12-20 mm *Euphorbia paralias* 20
Leaves opposite; leaves distanced; plant annual; blade length 4-9 mm *Euphorbia chamaepeplus* 20
- 19(17). Plant glabrous; leaves alternate; leaves overlapped; plant perennial *Phyllanthus reticulatus* 20
Plant hirsute; leaves opposite; leaves distanced; plant annual *Euphorbia forsskalii* 20
- 20(17). Base of blade acute-cuneate; blade width 2-10 mm; leaves 3-lobed; leaf apex acute-acuminate *Chrozophora plicata* 20
Base of blade rotundate; blade width 22-32 mm; leaves simple; leaf apex rotundate *Chrozophora tinctoria* 20
- 21(1). Leaves sessile 22
- Leaves subsessile 28
Leaves petioled 29
- 22(21). Blade length 4-9 mm *Euphorbia parvula* 29
Blade length 12-20 mm *Euphorbia exigua* 25
Blade length 25-70 mm 23
- 23(22). Leaves alternate 24
Leaves opposite 26
- 24(23). Plant glabrous; leaves overlapped; plant perennial; leaf margin entire 25
Plant hirsute; leaves distanced; plant annual; leaf margin dentate-serrate *Euphorbia arguta* 25
- 25(24). Leaf apex acute-acuminate; seeds brown-black; plant shrub *Euphorbia dendroides* 25
Leaf apex mucronate; seeds white or grey; plant herb *Euphorbia terracina* 25
- 26(23). Plant annual 27
Plant perennial *Euphorbia retusa* 27
- 27(26). Leaf margin entire; base of blade rotundate; seeds brown-black *Euphorbia dracunculoides* subsp. *inconspicua* 27
Leaf margin dentate-serrate; base of blade acute-cuneate; seeds white or grey *Euphorbia grossheimii* 27
- 28(21). Plant glabrous; leaves alternate; leaves overlapped; plant perennial *Phyllanthus maderaspatensis* 27
Plant tomentose; leaves opposite; leaves distanced; plant annual *Euphorbia arabica* 27
- 29(21). Plant glabrous; leaves simple; leaves distanced; plant annual *Euphorbia acalyphoides* 27
Plant tomentose; leaves 3-lobed; leaves overlapped; plant perennial *Chrozophora oblongifolia* 27
- 30(1). Leaf margin entire 31
Leaf margin dentate-serrate 32
- 31(30). Leaves overlapped; plant annual; leaf apex mucronate; inflorescence umbel *Euphorbia falcata* 31
Leaves distanced; plant perennial; leaf apex rotundate; inflorescence cymose *Euphorbia cuneata* 31
- 32(30). Plant glabrous *Euphorbia helioscopia* 31
Plant hirsute *Euphorbia oxydonta* 31
- 33(1). Blade length 4-9 mm; inflorescence umbel; blade width 2-10 mm *Euphorbia sanctae-catherinae* 31
Blade length 12-20 mm; inflorescence raceme; blade width 22-32 mm *Andrachne aspera* 31
Blade length 25-70 mm; inflorescence cymose; blade width 50-60 mm *Jatropha glauca* 31
Blade length 120 mm or more; inflorescence spike; blade width 130 mm or more *Ricinus communis* 31

The Detailed Descriptions *Andrachne aspera* Spreng.

Plant perennial, shrub. prostrate. hirsute. Milky latex absent. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. petioled. alternate. distanced. suborbicular. Sides of leaf blade equal. Leaf apex rotundate. Leaf margin entire. Base of blade symmetrical. cordate. Blade length 12–20 mm. Blade width 22–32 mm. Blade length/width ratio 0.8. Inflorescence axillary. raceme. Cyathium monoecious. Female flowers one. Petals five. Staminal filaments free. Fruit capsule. Locules three. Fruit length 3.5 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule two. Seed length 1.5 mm.

Seeds brown-black. without shallow depressions. Caruncle absent.

***Andrachne telephioides* L.**

Plant perennial. shrub. prostrate. glabrous. Milky latex absent. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. subsessile. alternate. distanced. ovate. Sides of leaf blade equal. Leaf apex rotundate. Leaf margin entire. Base of blade symmetrical. rotundate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 1.9. Inflorescence axillary. raceme. Cyathium monoecious. Female flowers one. Petals five. Staminal filaments free. Fruit capsule. Locules three. Fruit length 3 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule two. Seed length 1.5 mm. Seeds brown-black. without shallow depressions. Caruncle absent.

***Chrozophora brocchiana* (Vis.) Schweinf.**

Plant perennial. Plant shrub. Plant erects. Plant tomentose. Milky latex absent. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole present. Petiole-blade attachment basal. Midrib prominent. Leaves 3-lobed. Leaves petioled. Leaves alternate. Leaves overlapped. Leaves ovate. Sides of leaf blade equal. Leaf apex rotundate. Leaf margins sinuate. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 1.8. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals five. Staminal filaments free. Fruit capsule. Locules three. Fruit length 6 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 4 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Chrozophora oblongifolia* (Delile) A. Juss. ex Spreng.**

Plant perennial. Plant herb. Plant erects. Plant tomentose. Milky latex absent. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole present. Petiole-blade attachment basal. Midrib prominent. Leaves 3-lobed. Leaves petioled. Leaves alternate. Leaves overlapped. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margins sinuate. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 3.7. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female

flowers more than one. Petals five. Staminal filaments free. Fruit capsule. Locules three. Fruit length 8 mm. Fruit glabrous. Fruit surface warty. Seeds per locule one. Seed length 4 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Chrozophora plicata* (Vahl) A. Juss. ex Spreng.**

Plant annual. Plant herb. Plant prostrates. Plant tomentose. Milky latex absent. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole present. Petiole-blade attachment basal. Midrib prominent. Leaves 3-lobed. Leaves petioled. Leaves alternate. Leaves distanced. Leaves elliptical-rhombic. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margins sinuate. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 2.2. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals five. Staminal filaments free. Fruit capsule. Locules three. Fruit length 8 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 4 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Chrozophora tinctoria* (L.) Raf.**

Plant annual. Plant herb. Plant erects. Plant tomentose. Milky latex absent. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole present. Petiole-blade attachment basal. Midrib prominent. Leaves simple. Leaves petioled. Leaves alternate. Leaves distanced. Leaves elliptical-rhombic. Sides of leaf blade equal. Leaf apex rotundate. Leaf margins sinuate. Base of blade symmetrical. Base of blade rotundate. Blade length 25–70 mm. Blade width 22–32 mm. Blade length/width ratio 1.7. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers more than one. Petals five. Staminal filaments free. Fruit capsule. Locules three. Fruit length 8 mm. Fruit glabrous. Fruit surface warty. Seeds per locule one. Seed length 3 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Euphorbia acalyphoides* Hochst. ex Boiss.**

Plant annual. Plant herb. Plant erect. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves petioled. Leaves alternate. Leaves distanced. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex rotundate. Leaf margin entire. Base of blade

symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 4.1. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 4.5 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 2.5 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Euphorbia arabica* Hochst. & Steud. ex T. Anderson**

Plant annual. Plant herb. Plant erects. Plant tomentose. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves distanced. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin entire. Base of blade symmetrical. Base of blade rotundate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 10.7. Inflorescence axillary. Inflorescence cymose. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 1.5 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 1.2 mm. Seeds brown-black. Seeds with shallow depressions. Caruncle absent.

***Euphorbia arguta* Banks & Sol.**

Plant annual. Plant herb. Plant erects. Plant hirsute. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib prominent. Leaves simple. Leaves sessile. Leaves alternate. Leaves distanced. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 3.8. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 3.5 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 2 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia bivonae* Steud.**

Plant perennial. Plant shrub. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands

on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves alternate. Leaves distanced. Leaves obovate. Sides of leaf blade equal. Leaf apex mucronate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 3. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 3.5 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 2.5 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia chamaepeplus* Boiss. & Gaill.**

Plant annual. Plant herb. Plant erects. Plant glabrous. Milky latex present. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves opposite. Leaves distanced. Leaves elliptical-rhombic. Sides of leaf blade equal. Leaf apex rotundate. Leaf margin entire. Base of blade symmetrical. Base of blade rotundate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 3. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 2 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 1.5 mm. Seeds brown-black. Seeds with shallow depressions. Caruncle present.

***Euphorbia chmaesyce* L.**

Plant annual. Plant herb. Plant prostrates. Plant hirsute. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves overlapped. Leaves ovate. Sides of leaf blade unequal. Leaf apex rotundate. Leaf margin dentate-serrate. Base of blade asymmetrical. Base of blade rotundate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 1.8. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 2 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 1.5 mm. Seeds brown-black. Seeds with shallow depressions. Caruncle present.

***Euphorbia cuneata* Vahl**

Plant perennial. Plant shrub. Plant erects. Plant glabrous. Milky latex present. Stem branching above the base. Lateral branches ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves alternate. Leaves distanced. Leaves oblanceolate-spatheolate. Sides of leaf blade equal. Leaf apex rotundate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 3.3. Inflorescence axillary. Inflorescence cymose. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 7 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 2.5 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia dendroides* L.**

Plant perennial. Plant shrub. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves alternate. Leaves overlapped. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 8.7. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 6 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 3.5 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia dracunculoides* Lam. subsp. *inconspicua* (Baill.) Maire**

Plant annual. Plant herb. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves opposite. Leaves distanced. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin entire. Base of blade symmetrical. Base of blade rotundate. Blade length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 6. Inflorescence terminal. Inflorescence umbel.

Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 2.8 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 2.5 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia exigua* L.**

Plant annual. Plant herb. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves alternate. Leaves overlapped. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 10. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 2 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 1.2 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia falcata* L.**

Plant annual. Plant herb. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves alternate. Leaves overlapped. Leaves oblanceolate-spatheolate. Sides of leaf blade equal. Leaf apex mucronate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 4.5. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 2 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 1.5 mm. Seeds brown-black. Seeds with shallow depressions. Caruncle present.

***Euphorbia forsskalii* J. Gay**

Plant annual. Plant herb. Plant prostrates. Plant hirsute. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves distanced. Leaves elliptical-rhombic. Sides of leaf blade unequal. Leaf

apex rotundate. Leaf margin dentate-serrate. Base of blade asymmetrical. Base of blade rotundate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 3. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 2 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 1 mm. Seeds white or grey. Seeds with shallow depressions. Caruncle absent.

***Euphorbia granulata* Forssk.**

Plant annual. Plant herb. Plant prostrates. Plant hirsute. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves overlapped. Leaves obovate. Sides of leaf blade unequal. Leaf apex rotundate. Leaf margin entire. Base of blade asymmetrical. Base of blade rotundate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 2. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 1.5 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 1 mm. Seeds brown-black. Seeds with shallow depressions. Caruncle absent.

***Euphorbia grossheimii* (Prokh.) Prokh.**

Plant annual. Plant herb. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves opposite. Leaves distanced. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 9.6. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 8 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 3.5 mm. Seeds white or grey. Seeds without shallow depressions. Caruncle present.

***Euphorbia helioscopia* L.**

Plant annual. Plant herb. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base.

Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves alternate. Leaves distanced. Leaves oblanceolate-spatheolate. Sides of leaf blade equal. Leaf apex rotundate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 2.1. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 3.5 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 2 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia heterophylla* L.**

Plant annual. Plant herb. Plant erects. Plant hirsute. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib prominent. Leaves simple. Leaves petioled. Leaves alternate. Leaves overlapped. Leaves ovate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 22–32 mm. Blade length/width ratio 2.1. Inflorescence axillary. Inflorescence cymose. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 5.5 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 2.5 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia hierosolymitana* Boiss.**

Plant perennial. Plant shrub. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves alternate. Leaves distanced. Leaves obovate. Sides of leaf blade equal. Leaf apex rotundate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 2.5. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 4 mm. Fruit glabrous. Fruit surface warty. Seeds per locule one.

Seed length 3 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia hirta* L.**

Plant annual. Plant herb. Plant erects. Plant hirsute. Milky latex present. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves distanced. Leaves ovate. Sides of leaf blade unequal. Leaf apex acute-acuminate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 3. Inflorescence axillary. Inflorescence cymose. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 1.2 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 0.8 mm. Seeds brown-black. Seeds with shallow depressions. Caruncle absent.

***Euphorbia hypericifolia* L.**

Plant annual. Plant herb. Plant erects. Plant hirsute. Milky latex present. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves distanced. Leaves ovate. Sides of leaf blade unequal. Leaf apex rotundate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade rotundate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 3. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 2 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 1 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Euphorbia hyssopifolia* L.**

Plant annual. Plant herb. Plant prostrates. Plant glabrous. Milky latex present. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment

basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves distanced. Leaves ovate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin dentate-serrate. Base of blade asymmetrical. Base of blade acute-cuneate.

Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 2.5. Inflorescence axillary. Inflorescence cymose. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 2 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 1 mm. Seeds white or grey. Seeds with shallow depressions. Caruncle present.

Euphorbia inaequilatera* Sond. var. *inaequilatera

Plant annual. Plant herb. Plant prostrates. Plant glabrous. Milky latex absent. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves distanced. Leaves ovate. Sides of leaf blade unequal. Leaf apex rotundate. Leaf margin entire. Base of blade asymmetrical. Base of blade cordate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 2.2. Inflorescence axillary. Inflorescence cymose. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 1.8 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 1.5 mm. Seeds white or grey. Seeds with shallow depressions. Caruncle present.

***Euphorbia indica* Lam.**

Plant annual. Plant herb. Plant erects. Plant hirsute. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves distanced. Leaves ovate. Sides of leaf blade unequal. Leaf apex rotundate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade rotundate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 2.4. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 2 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 1 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia oxyodonta* Boiss. & Haussk.**

Plant annual. Plant herb. Plant erects. Plant hirsute. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile.

Leaves alternate. Leaves distanced. Leaves oblanceolate-spatheolate. Sides of leaf blade equal. Leaf apex rotundate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 2.6. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 4 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 2.5 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia paralias* L.**

Plant perennial. Plant shrub. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves alternate. Leaves overlapped. Leaves elliptical-rhombic. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin entire. Base of blade symmetrical. Base of blade rotundate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 3.7. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 5.5 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 3 mm. Seeds brown-black. Seeds with shallow depressions. Caruncle present.

***Euphorbia parvula* Delile**

Plant annual. Plant herb. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves alternate. Leaves overlapped. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex mucronate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 4. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 1.5 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 1.2 mm. Seeds white or grey. Seeds without shallow depressions. Caruncle present.

***Euphorbia peplis* L.**

Plant annual. Plant herb. Plant prostrates. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves overlapped. Leaves ovate. Sides of leaf blade unequal. Leaf apex rotundate. Leaf margin dentate-serrate. Base of blade asymmetrical. Base of blade rotundate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 2.3. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 4 mm. Fruit with hairs on ribs. Fruit surface not warty. Seeds per locule one. Seed length 2 mm. Seeds white or grey. Seeds without shallow depressions. Caruncle absent.

***Euphorbia peplus* L.**

Plant annual. Plant herb. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves petioled. Leaves opposite. Leaves overlapped. Leaves obovate. Sides of leaf blade equal. Leaf apex rotundate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 1.7. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 2 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 1.5 mm. Seeds white or grey. Seeds with shallow depressions. Caruncle present.

***Euphorbia petiolata* Banks & Sol.**

Plant annual. Plant herb. Plant erects. Plant tomentose. Milky latex absent. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves petioled. Leaves alternate. Leaves distanced. Leaves ovate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin entire. Base of blade symmetrical. Base of blade rotundate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 2.3. Inflorescence axillary. Inflorescence cymose. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule.

Locules three. Fruit length 6 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 4 mm. Seeds brown-black. Seeds with shallow depressions. Caruncle present.

***Euphorbia prostrata* Ait.**

Plant annual. Plant herb. Plant prostrates. Plant hirsute. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves distanced. Leaves ovate. Sides of leaf blade equal. Leaf apex rotundate. Leaf margin entire. Base of blade symmetrical. Base of blade rotundate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 2. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 1.5 mm. Fruit with hairs on ribs. Fruit surface not warty. Seeds per locule one. Seed length 1 mm. Seeds brown-black. Seeds with shallow depressions. Caruncle absent.

***Euphorbia punctata* Delile**

Plant annual. Plant herb. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves opposite. Leaves distanced. Leaves ovate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 1.7. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 2 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 1.5 mm. Seeds white or grey. Seeds with shallow depressions. Caruncle present.

***Euphorbia retusa* Forssk.**

Plant perennial. Plant herb. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves opposite. Leaves distanced. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade rotundate. Blade

length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 7.7. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 6 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 2.5 mm. Seeds white or grey. Seeds without shallow depressions. Caruncle present.

***Euphorbia sanctae-catherinae* A. Fayed**

Plant perennial. Plant shrub. Plant erects. Plant glabrous. Milky latex present. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves alternate. Leaves overlapped. Leaves suborbicular. Sides of leaf blade equal. Leaf apex mucronate. Leaf margin entire. Base of blade symmetrical. Base of blade rotundate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 1.3. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 3 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 2.5 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Euphorbia serpens* Kunth**

Plant annual. Plant herb. Plant prostrates. Plant glabrous. Milky latex absent. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves opposite. Leaves distanced. Leaves ovate. Sides of leaf blade unequal. Leaf apex rotundate. Leaf margin entire. Base of blade asymmetrical. Base of blade cordate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 1.4. Inflorescence axillary. Inflorescence cymose. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 1.8 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 1 mm. Seeds white or grey. Seeds without shallow depressions. Caruncle present.

***Euphorbia scordifolia* Jacq.**

Plant annual. Plant herb. Plant prostrates. Plant tomentose. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves

subsessile. Leaves opposite. Leaves distanced. Leaves ovate. Sides of leaf blade unequal. Leaf apex rotundate. Leaf margin dentate-serrate. Base of blade asymmetrical. Base of blade rotundate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 2. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 1.8 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 1.2 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Euphorbia terracina* L.**

Plant perennial. Plant herb. Plant erects. Plant glabrous. Milky latex present. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves sessile. Leaves alternate. Leaves overlapped. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex mucronate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 5.8. Inflorescence terminal. Inflorescence umbel. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 4 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 2 mm. Seeds white or grey. Seeds without shallow depressions. Caruncle present.

***Flueggia virosa* (Willd.) Voigt.**

Plant perennial. Plant shrub. Plant erects. Plant glabrous. Milky latex absent. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves petioled. Leaves alternate. Leaves overlapped. Leaves obovate. Sides of leaf blade equal. Leaf apex mucronate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 2. Inflorescence axillary. Inflorescence raceme. Cyathium dioecious. Female flowers one. Petals absent. Staminal filaments free. Fruit drupe. Locules three. Fruit length 3.5 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule two. Seed length 2 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Jatropha glauca* Vahl**

Plant perennial. Plant shrub. Plant erects. Plant glabrous. Milky latex absent. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib prominent. Leaves 5-lobed. Leaves petioled. Leaves alternate. Leaves overlapped. Leaves suborbicular. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 50–60 mm. Blade length/width ratio 1.3. Inflorescence terminal. Inflorescence cymose. Cyathium monoecious. Female flowers one. Petals five. Staminal filaments free. Fruit capsule. Locules three. Fruit length 10 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule one. Seed length 8 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Mercurialis annua* L.**

Plant annual. Plant herb. Plant erects. Plant glabrous. Milky latex absent. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole present. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves petioled. Leaves opposite. Leaves overlapped. Leaves ovate. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 22–32 mm. Blade length/width ratio 2.1. Inflorescence axillary. Inflorescence spike. Cyathium dioecious. Female flowers more than one. Petals absent. Staminal filaments free. Fruit capsule. Locules two. Fruit length 4 mm. Fruit with hairs on surface. Fruit surface not warty. Seeds per locule one. Seed length 2 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle present.

***Phyllanthus maderaspatensis* L.**

Plant perennial. Plant shrub. Plant erects. Plant glabrous. Milky latex absent. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves alternate. Leaves overlapped. Leaves linear-lanceolate. Sides of leaf blade equal. Leaf apex mucronate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 12–20 mm. Blade width 2–10 mm. Blade length/width ratio 6. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female

flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 3 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule two. Seed length 1 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Phyllanthus nummularifolia* Poir.**

Plant perennial. Plant herb. Plant erects. Plant hirsute. Milky latex absent. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves alternate. Leaves overlapped. Leaves obovate. Sides of leaf blade equal. Leaf apex mucronate. Leaf margin entire. Base of blade symmetrical. Base of blade rotundate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 1.7. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments free. Fruit capsule. Locules three. Fruit length 5 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule two. Seed length 2 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Phyllanthus reticulatus* Poir.**

Plant perennial. Plant shrub. Plant prostrates. Plant glabrous. Milky latex absent. Stem branching above the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves alternate. Leaves overlapped. Leaves elliptical-rhombic. Sides of leaf blade equal. Leaf apex acute-acuminate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 25–70 mm. Blade width 2–10 mm. Blade length/width ratio 2.7. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments united in bundles. Fruit drupe. Locules four or more. Fruit length 5 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule two. Seed length 2 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Phyllanthus rotundifolius* Klein ex Willd.**

Plant annual. Plant herb. Plant erects. Plant glabrous. Milky latex absent. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole absent. Petiole-blade attachment basal. Midrib not prominent. Leaves simple. Leaves subsessile. Leaves alternate. Leaves overlapped. Leaves obovate. Sides of leaf blade equal. Leaf apex

rotundate. Leaf margin entire. Base of blade symmetrical. Base of blade acute-cuneate. Blade length 4–9 mm. Blade width 2–10 mm. Blade length/width ratio 1.8. Inflorescence axillary. Inflorescence raceme. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments united in bundles. Fruit capsule. Locules three. Fruit length 6 mm. Fruit glabrous. Fruit surface not warty. Seeds per locule two. Seed length 4 mm. Seeds brown-black. Seeds without shallow depressions. Caruncle absent.

***Ricinus communis* L.**

Plant perennial. Plant shrub. Plant erects. Plant glabrous. Milky latex absent. Stem branching at the base. Lateral branches not ending in a spine. Glands on petiole present. Petiole-blade attachment peltate. Midrib prominent. Leaves 7 or more lobed. Leaves petioled. Leaves alternate. Leaves distanced. Leaves suborbicular. Sides of leaf blade equal. Leaf apex mucronate. Leaf margin dentate-serrate. Base of blade symmetrical. Base of blade cordate. Blade length 120 mm or more. Blade width 130 mm or more. Blade length/width ratio 0.9. Inflorescence terminal. Inflorescence spike. Cyathium monoecious. Female flowers one. Petals absent. Staminal filaments united in bundles. Fruit capsule. Locules three. Fruit length 16 mm. Fruit glabrous. Fruit surface warty. Seeds per locule one. Seed length 12 mm. Seeds variegated. Seeds without shallow depressions. Caruncle present.

Item Descriptions

Characters and character-states in these descriptions are represented by the serial numbers assigned to them in section 2.1. The List of Characters. The number of a given character in a taxon is separated from the number of its state by a comma, while a distance separates any two successive characters. The sequence of characters is the same as in section 2.3. The Detailed Descriptions.

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# \b{i}Andrachne aspera \i0{Spreng.\b0{}/
1,2,2,1 3,2 4,3 5,2 6,1 7,2 8,2 9,1 10,2 11,1 12,3 13,1 14,2 15,6 16,1 17,2 18,1
19,1 20,3 21,2 22,2 23,0,8 24,1 25,1 26,1 27,1 28,1 29,1 30,1 31,2 32,3,5 33,3
34,2 35,2 36,1,5 37,1 38,2 39,2
# \b{i}Andrachne telephioides \i0{L.\b0{}/
1,2,2,1 3,2 4,1 5,2 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,1 14,2 15,1 16,1 17,2 18,1
19,1 20,2 21,1 22,1 23,1,9 24,1 25,1 26,1 27,1 28,1 29,1 30,1 31,2 32,3 33,3
34,2 35,2 36,1,5 37,1 38,2 39,2
# \b{i}Chrozophora brocchiana \i0{(Vis.) Schweinf.\b0{}/
1,2,2,1 3,1 4,2 5,2 6,2 7,2 8,1 9,1 10,1 11,2 12,3 13,1 14,1 15,1 16,1 17,2 18,3
19,1 20,1 21,2 22,1 23,1,8 24,1 25,1 26,1 27,1 28,1 29,1 30,1 31,2 32,6 33,3
34,2 35,1 36,4 37,1 38,2 39,2
# \b{i}Chrozophora oblongifolia \i0{(Delile) A. Juss. ex Spreng.\b0{}/
1,2,2,2 3,1 4,2 5,2 6,2 7,2 8,1 9,1 10,1 11,2 12,3 13,1 14,1 15,4 16,1 17,1 18,3
19,1 20,1 21,3 22,1 23,3,7 24,1 25,1 26,1 27,2 28,1 29,1 30,1 31,2 32,8 33,3
34,1 35,1 36,4 37,1 38,2 39,2
# \b{i}Chrozophora plicata \i0{(Vahl) A. Juss. ex Spreng.\b0{}/
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- 1,1 2,2 3,2 4,2 5,2 6,2 7,2 8,1 9,1 10,1 11,2 12,3 13,1 14,2 15,3 16,1 17,1 18,3
19,1 20,1 21,3 22,1 23,2,2 24,1 25,1 26,1 27,1 28,1 29,1 30,1 31,2 32,8 33,2
34,2 35,1 36,4 37,1 38,2 39,2
\b\i{}Chrozophora tinctoria \iO{}(L.) Raf.\bO{}/
1,1 2,2 3,1 4,2 5,2 6,2 7,2 8,1 9,1 10,1 11,1 12,3 13,1 14,2 15,3 16,1 17,2 18,3
19,1 20,2 21,3 22,2 23,1,7 24,1 25,1 26,1 27,2 28,1 29,1 30,1 31,2 32,8 33,3
34,1 35,1 36,3 37,1 38,2 39,2
\b\i{}Euphorbia acalyphoides \iO{}Hochst. ex Boiss.\bO{}/
1,1 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,3 13,1 14,2 15,4 16,1 17,2 18,1
19,1 20,1 21,3 22,1 23,4,1 24,1 25,1 26,1 27,1 28,2 29,1 30,1 31,2 32,4,5 33,2
34,2 35,1 36,2,5 37,1 38,2 39,2
\b\i{}Euphorbia arabica \iO{}Hochst. & Steud. ex T. Anderson\bO{}/
1,1 2,2 3,1 4,2 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,2 15,4 16,1 17,1 18,1
19,1 20,2 21,2 22,1 23,10,7 24,1 25,2 26,1 27,1 28,2 29,1 30,1 31,2 32,1,5
33,2 34,2 35,1 36,1,2 37,1 38,1 39,2
\b\i{}Euphorbia arguta \iO{}Banks & Sol.\bO{}/
1,1 2,2 3,1 4,3 5,1 6,1 7,2 8,2 9,1 10,1 11,1 12,1 13,1 14,2 15,4 16,1 17,1 18,2
19,1 20,1 21,3 22,1 23,3,8 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,3,5 33,3
34,2 35,1 36,2 37,1 38,2 39,1
\b\i{}Euphorbia biconvae \iO{}Steud.\bO{}/
1,2 2,1 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,1 14,2 15,2 16,1 17,3 18,1
19,1 20,1 21,2 22,1 23,3 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,3,5 33,2
34,2 35,1 36,2,5 37,1 38,2 39,1
\b\i{}Euphorbia chamaepeplus \iO{}Boiss. & Gaill.\bO{}/
1,1 2,2 3,1 4,1 5,1 6,2 7,2 8,2 9,1 10,2 11,1 12,1 13,2 14,2 15,3 16,1 17,2 18,1
19,1 20,2 21,1 22,1 23,3,2 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,2 33,3
34,2 35,1 36,1,5 37,1 38,1 39,1
\b\i{}Euphorbia chmaesyce \iO{}L.\bO{}/
1,1 2,2 3,2 4,3 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,1 15,1 16,2 17,2 18,2
19,2 20,2 21,1 22,1 23,1,8 24,1 25,1 26,1 27,1 28,2 29,1 30,1 31,2 32,2 33,3
34,2 35,1 36,1,5 37,1 38,1 39,1
\b\i{}Euphorbia cuneata \iO{}Vahl\bO{}/
1,2 2,1 3,1 4,1 5,1 6,2 7,1 8,2 9,1 10,2 11,1 12,1 13,1 14,2 15,5 16,1 17,2 18,1
19,1 20,1 21,2 22,1 23,3,3 24,1 25,2 26,1 27,1 28,2 29,1 30,1 31,2 32,7 33,2
34,2 35,1 36,2,5 37,1 38,2 39,1
\b\i{}Euphorbia dendroides \iO{}L.\bO{}/
1,2 2,1 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,1 14,1 15,4 16,1 17,1 18,1
19,1 20,1 21,3 22,1 23,8,7 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,6 33,3
34,2 35,1 36,3,5 37,1 38,2 39,1
\b\i{}Euphorbia dracunculoides \iO{}Lam. subsp. \i{}jinconspicua \iO{}(Baill.)
Maire\bO{}/
1,1 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,2 14,2 15,4 16,1 17,1 18,1
19,1 20,2 21,3 22,1 23,6 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,2,8 33,3
34,2 35,1 36,2,5 37,1 38,2 39,1
\b\i{}Euphorbia exigua \iO{}L.\bO{}/
1,1 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,1 14,1 15,4 16,1 17,1 18,1
19,1 20,1 21,2 22,1 23,10 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,2 33,3
34,2 35,1 36,1,2 37,1 38,2 39,1
\b\i{}Euphorbia falcata \iO{}L.\bO{}/
1,1 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,1 14,1 15,5 16,1 17,3 18,1
19,1 20,1 21,2 22,1 23,4,5 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,3,3
34,2 35,1 36,1,5 37,1 38,1 39,1
\b\i{}Euphorbia forsskalii \iO{}J. Gay\bO{}/
1,1 2,2 3,2 4,3 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,2 15,3 16,2 17,2 18,2
19,2 20,2 21,1 22,1 23,3 24,1 25,1 26,1 27,1 28,2 29,1 30,1 31,2 32,2 33,2
34,2 35,1 36,1 37,2 38,1 39,2
\b\i{}Euphorbia granulata \iO{}Forssk.\bO{}/
1,1 2,2 3,2 4,3 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,1 15,2 16,2 17,2 18,1
19,2 20,2 21,1 22,1 23,2 24,1 25,1 26,1 27,1 28,2 29,1 30,1 31,2 32,1,5 33,2
34,2 35,1 36,1 37,1 38,1 39,2
\b\i{}Euphorbia grossheimii \iO{}(Prokh.) Prokh.\bO{}/
1,1 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,2 14,2 15,4 16,1 17,1 18,2
19,1 20,1 21,3 22,1 23,9,6 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,8 33,3
34,2 35,1 36,3,5 37,2 38,2 39,1
\b\i{}Euphorbia helioscopia \iO{}L.\bO{}/
1,1 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,1 14,2 15,5 16,1 17,2 18,2
19,1 20,1 21,2 22,1 23,2,1 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,3,5 33,3
34,2 35,1 36,2 37,1 38,2 39,1
\b\i{}Euphorbia heterophylla \iO{}L.\bO{}/
1,1 2,2 3,1 4,3 5,1 6,1 7,2 8,2 9,1 10,1 11,1 12,3 13,1 14,1 15,1 16,1 17,1 18,2
19,1 20,1 21,3 22,2 23,2,1 24,1 25,2 26,1 27,1 28,2 29,1 30,1 31,2 32,5,5 33,3
34,2 35,1 36,2,5 37,1 38,2 39,1
\b\i{}Euphorbia hierosolymitana \iO{}Boiss.\bO{}/
1,2 2,1 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,1 14,2 15,2 16,1 17,2 18,1
19,1 20,1 21,2 22,1 23,2,5 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,4 33,3
- 34,1 35,1 36,3 37,1 38,2 39,1
\b\i{}Euphorbia hirta \iO{}L.\bO{}/
1,1 2,2 3,1 4,3 5,1 6,2 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,2 15,1 16,2 17,1 18,2
19,1 20,1 21,3 22,1 23,3 24,1 25,2 26,1 27,1 28,2 29,1 30,1 31,2 32,1,2 33,2
34,2 35,1 36,0,8 37,1 38,1 39,2
\b\i{}Euphorbia hypericifolia \iO{}L.\bO{}/
1,1 2,2 3,1 4,3 5,1 6,2 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,2 15,1 16,2 17,2 18,2
19,1 20,2 21,2 22,1 23,3 24,1 25,1 26,1 27,1 28,2 29,1 30,1 31,2 32,2 33,2
34,2 35,1 36,1 37,1 38,2 39,2
\b\i{}Euphorbia hyssopifolia \iO{}L.\bO{}/
1,1 2,2 3,2 4,1 5,1 6,2 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,2 15,1 16,1 17,1 18,2
19,2 20,1 21,2 22,1 23,2,5 24,1 25,2 26,1 27,1 28,2 29,1 30,1 31,2 32,2 33,3
34,2 35,1 36,1 37,2 38,1 39,1
\b\i{}Euphorbia inaequilatera \iO{}Sond. var. \i{}inaequilatera\bO{}/
1,1 2,2 3,2 4,1 5,2 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,2 15,1 16,2 17,2 18,1
19,2 20,3 21,1 22,1 23,2,2 24,1 25,2 26,1 27,1 28,2 29,1 30,1 31,2 32,1,8 33,3
34,2 35,1 36,1,5 37,2 38,1 39,1
\b\i{}Euphorbia indica \iO{}Lam.\bO{}/
1,1 2,2 3,1 4,3 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,2 15,1 16,2 17,2 18,2
19,1 20,2 21,2 22,1 23,2,4 24,1 25,1 26,1 27,1 28,2 29,1 30,1 31,2 32,2 33,3
34,2 35,1 36,1 37,1 38,2 39,1
\b\i{}Euphorbia oxodonta \iO{}Boiss. & Haussk.\bO{}/
1,1 2,2 3,1 4,3 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,1 14,2 15,5 16,1 17,2 18,2
19,1 20,1 21,2 22,1 23,2,6 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,4 33,3
34,2 35,1 36,2,5 37,1 38,2 39,1
\b\i{}Euphorbia paralias\bO{} \iO{}L.\bO{}/
1,2 2,1 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,1 14,1 15,3 16,1 17,1 18,1
19,1 20,2 21,2 22,1 23,3,7 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,5,5 33,3
34,2 35,1 36,3 37,1 38,1 39,1
\b\i{}Euphorbia parvula \iO{}Delile\bO{}/
1,1 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,1 14,1 15,4 16,1 17,3 18,1
19,1 20,1 21,1 22,1 23,4 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,1,5 33,3
34,2 35,1 36,1,2 37,2 38,2 39,1
\b\i{}Euphorbia peplis \iO{}L.\bO{}/
1,1 2,2 3,2 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,1 15,1 16,2 17,2 18,2
19,2 20,2 21,2 22,1 23,2,3 24,1 25,1 26,1 27,1 28,2 29,1 30,1 31,2 32,4 33,1
34,2 35,1 36,2 37,2 38,2 39,2
\b\i{}Euphorbia peplus \iO{}L.\bO{}/
1,1 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,3 13,2 14,1 15,2 16,1 17,2 18,1
19,1 20,1 21,2 22,1 23,1,7 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,2 33,3
34,2 35,1 36,1,5 37,2 38,1 39,1
\b\i{}Euphorbia petiolata \iO{}Banks & Sol.\bO{}/
1,1 2,2 3,1 4,2 5,2 6,2 7,2 8,2 9,1 10,2 11,1 12,3 13,1 14,2 15,1 16,1 17,1 18,1
19,1 20,2 21,1 22,1 23,2,3 24,1 25,2 26,1 27,1 28,2 29,1 30,1 31,2 32,6 33,2
34,2 35,1 36,4 37,1 38,1 39,1
\b\i{}Euphorbia prostrata \iO{}Ait.\bO{}/
1,1 2,2 3,2 4,3 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,2 15,1 16,1 17,2 18,1
19,1 20,2 21,1 22,1 23,2 24,1 25,1 26,1 27,1 28,2 29,1 30,1 31,2 32,1,5 33,1
34,2 35,1 36,1 37,1 38,1 39,2
\b\i{}Euphorbia punctata \iO{}Delile\bO{}/
1,1 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,2 14,2 15,1 16,1 17,1 18,1
19,1 20,1 21,1 22,1 23,1,7 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,2 33,3
34,2 35,1 36,1,5 37,2 38,1 39,1
\b\i{}Euphorbia retusa \iO{}Forssk.\bO{}/
1,2 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,2 14,2 15,4 16,1 17,1 18,2
19,1 20,2 21,3 22,1 23,7,7 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,6 33,3
34,2 35,1 36,2,5 37,2 38,2 39,1
\b\i{}Euphorbia sanctae-catherinae \iO{}A. Fayed\bO{}/
1,2 2,1 3,1 4,1 5,1 6,2 7,2 8,2 9,1 10,2 11,1 12,2 13,1 14,1 15,6 16,1 17,3 18,1
19,1 20,2 21,1 22,1 23,1,3 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,3 33,3
34,2 35,1 36,2,5 37,1 38,2 39,1
\b\i{}Euphorbia serpens \iO{}Kunth\bO{}/
1,1 2,2 3,2 4,1 5,2 6,2 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,2 15,1 16,2 17,2 18,1
19,2 20,3 21,1 22,1 23,1,4 24,1 25,2 26,1 27,1 28,2 29,1 30,1 31,2 32,1,8 33,3
34,2 35,1 36,1 37,2 38,2 39,1
\b\i{}Euphorbia scordifolia \iO{}Jacq.\bO{}/
1,1 2,2 3,2 4,2 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,2 14,2 15,1 16,2 17,2 18,2
19,2 20,2 21,1 22,1 23,2 24,1 25,1 26,1 27,1 28,2 29,1 30,1 31,2 32,1,8 33,2
34,2 35,1 36,1,2 37,1 38,2 39,2
\b\i{}Euphorbia terracina \iO{}L.\bO{}/
1,2 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,1 13,1 14,1 15,4 16,1 17,3 18,1
19,1 20,1 21,3 22,1 23,5,8 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,4 33,3
34,2 35,1 36,2 37,2 38,2 39,1
\b\i{}Flueggea virosa \iO{}(Willd.) Voigt.\bO{}/
1,1 2,2 3,1 4,1 5,1 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,1 14,2 15,2 16,1 17,2 18,1
19,1 20,1 21,2 22,1 23,2,5 24,2 25,3 26,1 27,1 28,2 29,1 30,1 31,2 32,4 33,3

1,2 2,1 3,1 4,1 5,2 6,1 7,2 8,2 9,1 10,2 11,1 12,3 13,1 14,1 15,2 16,1 17,3 18,1 19,1 20,1 21,3 22,1 23,2 24,1 25,1 26,2 27,1 28,2 29,1 30,2 31,2 32,3 33,3 34,2 35,2 36,2 37,1 38,2 39,2
\b{i}Jatropha glauca \i{Vah}\b{0}/
1,2 2,1 3,1 4,1 5,2 6,1 7,2 8,2 9,1 10,1 11,3 12,3 13,1 14,1 15,6 16,1 17,1 18,2 19,1 20,1 21,3 22,3 23,1 24,2 25,2 26,1 27,1 28,1 29,1 30,1 31,2 32,10 33,3 34,2 35,1 36,8 37,1 38,2 39,1
\b{i}Mercurialis annua \i{L}\b{0}/
1,1 2,2 3,1 4,1 5,2 6,1 7,2 8,1 9,1 10,2 11,1 12,3 13,2 14,1 15,1 16,1 17,1 18,2 19,1 20,1 21,3 22,2 23,2 24,1 25,4 26,2 27,2 28,2 29,1 30,1 31,1 32,4 33,2 34,2 35,1 36,2 37,1 38,2 39,1
\b{i}Phyllanthus maderaspatensis \i{L}\b{0}/
1,2 2,1 3,1 4,1 5,2 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,1 14,1 15,4 16,1 17,3 18,1 19,1 20,1 21,2 22,1 23,6 24,1 25,1 26,1 27,1 28,2 29,1 30,1 31,2 32,3 33,3 34,2 35,2 36,1 37,1 38,2 39,2
\b{i}Phyllanthus nummulariifolia \i{Poir}\b{0}/
1,2 2,2 3,1 4,3 5,2 6,2 7,2 8,2 9,1 10,2 11,1 12,2 13,1 14,1 15,2 16,1 17,3 18,1 19,1 20,2 21,1 22,1 23,1 24,1 25,1 26,1 27,1 28,2 29,1 30,1 31,2 32,5 33,3 34,2 35,2 36,2 37,1 38,2 39,2
\b{i}Phyllanthus reticulatus \i{Poir}\b{0}/
1,2 2,1 3,2 4,1 5,2 6,2 7,2 8,2 9,1 10,2 11,1 12,2 13,1 14,1 15,3 16,1 17,1 18,1 19,1 20,1 21,3 22,1 23,2 24,1 25,1 26,1 27,1 28,2 29,2 30,2 31,3 32,5 33,3 34,2 35,2 36,2 37,1 38,2 39,2
\b{i}Phyllanthus rotundifolius \i{Klein ex Willd.}\b{0}/
1,1 2,2 3,1 4,1 5,2 6,1 7,2 8,2 9,1 10,2 11,1 12,2 13,1 14,1 15,2 16,1 17,2 18,1 19,1 20,1 21,1 22,1 23,1 24,1 25,1 26,1 27,1 28,2 29,2 30,1 31,2 32,6 33,3 34,2 35,2 36,4 37,1 38,2 39,2
\b{i}Ricinus communis \i{L}\b{0}/
1,2 2,1 3,1 4,1 5,2 6,1 7,2 8,1 9,2 10,1 11,4 12,3 13,1 14,2 15,6 16,1 17,3 18,2 19,1 20,3 21,4 22,4 23,0 24,2 25,4 26,1 27,1 28,2 29,2 30,1 31,2 32,16 33,3 34,1 35,1 36,12 37,3 38,2 39,1

DISCUSSION

The two keys to the 48 succulent and non-succulent species representing the Euphorbiaceae *s.l.* (i.e., Euphorbiaceae *s.s.* and Phyllanthaceae) in the flora of Egypt provided in the present study are a marked improvement over any of the previous manually constructed keys to these taxa. Each computer-generated key is based on a large set of characters recorded comparatively for each taxon. Consequently, both keys are devoid of any pitfalls and contradictions which bugged their predecessors. Each key is supported by the detailed descriptions encompassing all characters and character-states used to construct it. Such detailed descriptions are an additional assurance of the correct identification obtained by the user of each key. The list of characters recorded for the succulent and non-succulent species was easily expandable to include a multitude of other potentially useful aspects of morphological variation. Among the advantages of comparative recording of characters intended for computer-generated keys are: (i) the character-states distinguishing between alternative entries of the same couplet are strictly comparative, and (ii) much fewer characters are usually needed to single out every species in the key from the rest. This is evident clearly in the present study: the preludes to the two keys show that only six of the 13 characters recorded for the succulent species were sufficient to successfully generate the required key, while only 22 of the 39 attributes scored for the non-succulent

species were adequate for key generation. In fact, the number of surplus characters is much greater than seven and 17 for the succulents and non-succulents, respectively, because the maximum number of characters needed to identify a species in the key to the non-succulents is nine (for *Euphorbia hierosolymitana* Boiss. and *E. bivonae* Steud.) as follows:

1. Leaves obovate	12
12(1). Blade length 12-20 mm	15
15(12). Leaves subsessile; leaves alternate; leaves distanced, plant perennial	16
16(15). Leaf apex rotundate; fruit glabrous; fruit surface warty	<i>Euphorbia hierosolymitana</i>
Leaf apex mucronate; fruit with hairs on surface; fruit surface warty	<i>E. bivonae</i>

All surplus characters in both cases appear in the detailed and item descriptions of individual species and serve the important function of confirming the results obtained by users of the two keys. Item descriptions are a useful substitute of the original data matrix used in key generation. Together with the list of characters, they can be used to re-synthesize the original data matrix which can then be modified to accommodate any taxa and/or characters in any future floristic studies of this family. This evident flexibility of computer-generated keys becomes particularly significant in the case of the taxa of Euphorbiaceae *s.l.* (*Euphorbia lasiocarpa* Klotzsch, *E. erinacea* Boiss. Et Kotschy, *E. petiolata* Banks et Sol., *E. sintenisii* Boiss. ex Freyn., *E. pterococca* Brot., *E. obovata* Decne.) recorded by Boulos (2000) but for which no material could be found in the largest two herbaria in Egypt CAI and CAIM.

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