

A synopsis of chinese *euphorbia* L. s.l. (euphorbiaceae)

J.S. MA JINSHUANG (J.S.MA) & C.Y. WU ZHENGYI (C.Y.WU)

Resum

MA JINSHUANG J. S. & C. Y. WU ZHENGYI (1992). Sinopsi del gènere *Euphorbia* L. s.l. (Euphorbiaceae) a la Xina. Collect. Bot. (Barcelona): 21:97-120.

Síntesi del tractament taxonòmic de les espècies d'*Euphorbia* s.l. de la Xina. En conjunt es reconeixen per aquest país 5 subgèneres, 12 seccions i 77 espècies (incloent cultivades i naturalitzades). També es presenten claus de subgèneres, seccions i espècies; a més s'aporta per a cada espècie lloc de publicació, sinònims i distribució a nivell provincial dins la Xina i més breument per a fora de la Xina, així com comentaris on siguin precisos. Es descriu una nova espècie (*E. tongchuanensis* Wu & Ma.) i un nova secció (*Sect. Wentsai* Wu & Ma.).

Mots claus: *Euphorbia*, Euphorbiaceae, Taxonomia, distribució geogràfica, Xina.

Abstract

MA JINSHUANG J. S. & C. Y. WU ZHENGYI (1992). A synopsis of chinese *Euphorbia* L. s.l. (Euphorbiaceae). Collect. Bot. (Barcelona): 21:97-120.

A taxonomic treatment of the Chinese species of *Euphorbia* (s.l.) is summarized. Altogether 5 subgenera, 12 sections and 77 species (including cultivated and escaped ones) are recognized as occurring in China. Keys to subgenera, sections and species of *Euphorbia* (s.l.) found in China are presented; the original literature of each species, synonyms and distribution to the provincial level within China and more briefly outside China, as well as comments where necessary, are reported also. One new species (*E. tongchuanensis* C. Y. Wu & J. S. Ma, sp. nov.) and one new section (*Sect. Wentsai* C. Y. Wu & J. S. Ma, sect. nov.) are described.

Keywords: *Euphorbia*, Euphorbiaceae, Taxonomy, Distribution, China.

INTRODUCTION

Based on herbarium material deposited in China and in western countries (A, BM, E, G, K, LE, NY, UPS, W, WU, and others), a taxonomic treatment of the Chinese species of the genus *Euphorbia* (s.l.) is summarized here for the first time. Altogether 5 subgenera, 12

J. S. MA JINSHUANG: Herbarium BNU, Department of Biology, Beijing Normal University, Beijing, 100875, Peoples Republic of China.

C. Y. WU ZHENGYI: Herbarium KUN, Kunming Institute of Botany, Academia Sinica, Kunming, 650204, Peoples Republic of China.

sections and 77 species (including cultivated and escaped ones) are recognized, and 97 species names are reduced to synonyms. Keys to the subgenera, sections and species of the genus *Euphorbia* (s.l.) found in China are presented, and the distribution to the provincial level within China and more briefly outside China, the references to the original publications and the synonyms of each species are also included. One new species and one new section are described in this paper.

BRIEF REVIEW ON TAXONOMIC HISTORY

Euphorbia (s.l.), one of the largest genera of flowering plants, has about 2000 species (Oudejans 1990). The first comprehensive work of the genus in the world is Boissier's treatment for DC *Prodromus* (1862). Later on, general treatments have been made by Pax (1891) and Pax & Hoffman (1931) for Engler's system. In more recent times some taxonomists (Prokhanov 1949, Hurusawa 1954, Tutin & Radcliffe-Smith 1966, Carter 1987) have treated the genus for specific areas but until now there exists no satisfactory system for all species of the world. Yet, the recent floristic work from Eurasia both those mentioned above and others (Rechinger & Schiman-Czeika 1964, Radcliffe-Smith 1982) makes it possible to understand and present an outline of the system of the Chinese *Euphorbia* species.

With respect to its flora, China is one of the richest countries in the world. However, there is no general authentic work on the Chinese *Euphorbia* species. From Linne's time to the 1980s, all taxonomic work on the genus in China is scattered and incomplete. In this period of about 240 years, about 175 species have been described or reported to occur in this country mainly by western investigators and very rarely and only recently by Chinese ones (Wang 1988, Lin & Hsieh 1991, Lin et al. 1991, Ma & Wu 1992a, b).

On behalf of the Editorial Committee of *Flora Reipublicae Popularis Sinicae* (FRPS), we have started to work on the genus *Euphorbia*. The primary work has been finished now and the manuscript for FRSP is in the preparation (vol. 44, pt. 2). This report, however, is only a primary summary of its contents.

KEY TO SUBGENERA AND SECTIONS OF CHINESE EUPHORBIA

1. Stem unarmed; leaves quickly fallen-off Subgen. 1, *Tirucalli*
1. Stem and leaves normally. 2
2. Trees or shrubs with succulent or fleshy stem; stipules usually prickly or spiny, rarely absent Subgen. 2, *Euphorbia*
2. Usually herbs, occasionally subshrub or woody at base; stipules normal or absent. 3
3. Leaves oblique at base, opposite; stipules membranaceous; glands appendiculate Subgen. 3, *Chamaesyce*
4. Subshrub at base; leaves coriaceous or subcoriaceous Sect. 1, *Sclerophyllae*
4. Herbs; leaves membranaceous or characeous. 5
5. Stem ascending to suberect; cyathia cymulose; leaves usually larger Sect. 2, *Hypericifoliae*
5. Stem prostrate; cyathia solitary; leaves usually smaller Sect. 3, *Chamaesyce*
3. Leaves symmetrical at base, usually not opposite; stipules membranaceous, glandular or absent; glands exappendiculate. 6
6. Stipules glandular; cyathia with 1 (2-3) glands Subgen. 4, *Poinsettia*
6. Stipules absent; cyathia with 4-5 glands Subgen. 5, *Esula*, 7
7. Leaves opposite and decussate; capsule with spongy pericarp, indehiscent Sect. 4, *Lathyris*

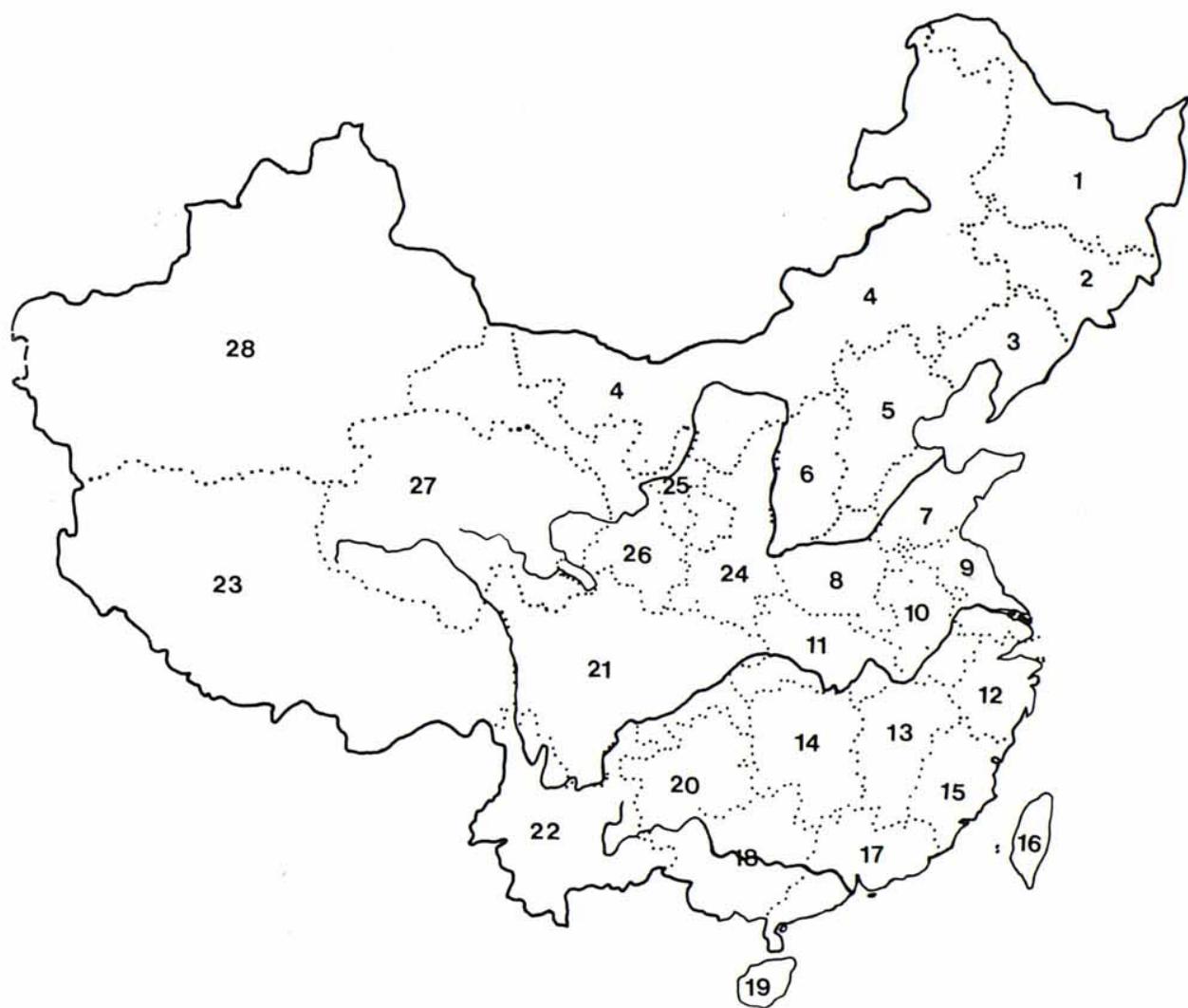


Fig. 1.—Map of the administrative divisions of China: 1, Heilongjiang; 2, Jilin; 3, Liaoning; 4, Inner Mongol; 5, Hebei; 6, Shansi; 7, Shandong; 8, Henan; 9, Jiangsu; 10, Anhui; 11, Hubei; 12, Zhejiang; 13, Jiangxi; 14, Hunan; 15, Fujian; 16, Taiwan; 17, Guangdong; 18, Guangxi; 19, Hainan; 20, Guizhou; 21, Sichuan; 22, Yunnan; 23, Xizang; 24, Shaansi; 25, Ningxia; 26, Kansu; 27, Qinghai; 28, Xinjiang; The three largest cities are included in Hebei (Beijing, Tianjin) and Jiangsu (Shanghai) respectively for statistics only; moreover, NE (1-3), N (4-6), C (7-14), S (15-19), SW (20-23), NW (24-28) China, are used in this paper.

| | |
|---|-------------------------------|
| 7. Leaves usually alternate, rarely opposite but never decussate; capsule indurate dehiscent. | 8 |
| 8. Glands suborbicular or ovate, neither horned nor truncate or emarginate at the outer margin. | 9 |
| 9. Glands 4, disciform, peltate inserted on the margin of cyathium; capsule ornamental | Sect. 5, <i>Helioscopiae</i> |
| 9. Glands usually 4, rarely 5, platyform, lateral inserted on the margin of cyathium. | 10 |
| 10. Capsule smooth. | 11 |
| 11. Glands 5; root linear | Sect. 6, <i>Chylogala</i> |
| 11. Glands 4; root rhizomatic | Sect. 7, <i>Tithymalus</i> |
| 10. Capsule verrucose; Glands 4 | Sect. 8, <i>Tulocarpa</i> |
| 8. Glands horned or truncated, fimbriate or emarginate. | 12 |
| 12. Leaves fleshy, palmately veined | Sect. 9, <i>Paralias</i> |
| 12. Leaves membranaceous, pinnately veined. | 13 |
| 13. Glands infundibular, with two horns at apex | Sect. 10, <i>Wentsai</i> |
| 13. Glands platyform, never infundibular. | 14 |
| 14. Annual; leaves opposite | Sect. 11, <i>Cymatosperum</i> |
| 14. Perennial, rarely annual; leaves alternate | Sect. 12, <i>Esula</i> |

TAXONOMIC TREATMENT

Before starting the treatment, some points should be explained: 1, the division at the section level is only given in subgen. *Chamaesyce* and subgen. *Esula*, the largest groups in this country; 2, no synonyms are given at the section level unless it is a combined name; 3, only for those species which are native to this country type information is given if available which is followed by a “!” mark when the authors have seen and identified it in this work; 4, no comment or description is given for a species unless this is needed for further explanation.

EUPHORBIA L., Sp. pl. 450, 1753; gen. pl. ed 5, 208, 1754; Boiss. in DC Prodr. 15 (2): 7, 1862; Benth. & Hook. f., Gen. pl. 3 (1): 258, 1880; Prokhanov in Fl. USSR 14: 304, 1949; Rechinger & Schiman-Czeika in Fl. Iran. 6 (1): 1, 1964; Tutin & Radcliffe-Smith in Fl. Eur. 2: 213, 1966; Radcliffe-Smith in Fl. Turkey 7: 571; 1982 et in Fl. Pakist. 172: 88, 1986.

TYPE: *Euphorbia antiquorum* L. (Lectotype, Millspaugh 1909).

Subgen. 1, **Tirucalli** (Boiss.) S. Carter in Kew Bull. 40: 823, 1985.

Syn.: *Euphorbia* sect. *Tirucalli* Boiss. in DC Prodr. 15 (2): 94, 1862.

TYPE: *E. tirucalli* L.

Native to Africa. 1 species cultivated in China (species 1).

1, ***E. tirucalli*** L., Sp. pl. 452, 1753.

Native to E Africa, cultivated in most botanical gardens of S & C China and in greenhouses of N China.

Subgen. 2, **Euphorbia**.

TYPE: *E. antiquorum* L.

Trees and shrubs, succulent.

Mostly native to Africa, rarely to Asia.

4 species in China (species 2-5).

KEY TO SUBGENUS *EUPHORBIA*

1. Spines arising from separate tubercles; cyathophyls red 2, *E. milii*
1. Spines paired on each spine-shield; cyathophyls usually scarious, not prominent. 2
2. Stem cylindrical with less 5 angles 3, *E. nerifolia*
2. Stem apparently with 3-5-7 angles, winged. 3
3. Stem commonly 3 angles; leaves at upper stem only 4, *E. royleana*
3. Stem usually 5-7 angles; leaves from edge of angle 5, *E. antiquorum*

2. ***E. milii*** Ch. des Moul. Bull. Hist. Nat. Soc. Linn. Bordeaux 1: 27, pl. 1, 1826.
Syn. *E. splendens* Bojer ex Hook., Bot. Mag. 56: t. 2902, 1829.
Native of Madagascar, also widely cultivated in China.

3. ***E. nerifolia*** L., Sp. pl. 451, 1753.
TYPE: "Habitat in India".
BOISSIER (1862) and HOOKER (1887) recorded this species described from India, but RADCLIFFE-SMITH (1986) recorded "Holotype: China cult? Osbeck in Hb. Linn. no. 630.1 (LINN)". However, we can not find the information about Osbeck to China in that very early time.
Distributed in India, Indochina and S & SW China, cultivated in N China.

4. ***E. royleana*** Boiss. in DC Prodr. 1 (2): 83, 1862.
Distribution: N India and S to SW China, also cultivated in N China.
TYPE: "Ad radices Himalayae in jugo Suen Royle s/n" (for further information see Radcliffe-Smith, 1986).

5. ***E. antiquorum*** L., Sp. pl. 450, 1753.
Distribution: The tropics of the Old World; S to SW China, cultivated in N China.
LECTOTYPE: India (Wijnands, Bot. Commelins: 96-97, 1983).

Subgen. 3, ***Poinsettia*** (Grah.) House in Bull. New York State Mus. 254; 472, 1924.

Syn: *Poinsettia* Grah. in Edinb. New Philos. J. 20: 412, 1836.

Annual or perennial; stipules gland-like; leaves alternate; cyathia in terminal cymes; bracteal leaves opposite; glands usually 1, rarely 2 or 3, without appendages.
LECTOTYPE: *Euphorbia pulcherrima* Willd. ex Klotzsch.
Native of New World, 6 species in China (species 6-11).

KEY TO SUBGENUS *POINSETTIA*

1. Upper leaves with colour modification. 2
2. Upper leaves uniformly bright scarlet 6, *E. pulcherrima*
2. Upper leaves green with a basal pale or red blotch. 3
3. Bracteal leaves usually red at base; cyathial glands bilabiate, the opening narrowly oblong 7, *E. cyathophylla*
3. Bracteal leaves green or pale at base; cyathial glands funnel-like, the opening circular 8, *E. heterophylla*
1. Upper leaves without colour modification. 4
4. Glands usually 3; leaves with long petiole 9, *E. hainanensis*

4. Glands usually 1, rarely 2-3; leaves sessile or subsessile. 5
 5. leaves usually denticulate at margin; seed obconic 10, *E. dentata*
 5. Leaves usually repand at margin; seed trigonous 11, *E. epilobiifolia*

6. ***E. pulcherrima*** Willd. ex Klotzsch in Allgem. Gartenz. 2: 27, 1834.

Native of C America from Mexico to Costa Rica; widely cultivated in most regions at China.

7. ***E. cyathophora*** Murr., Comment. Soc. Reg. Sci. Gotting. 7: 81, 1786.

Syn: *E. heterophylla* auct. non L.

All Chinese work regarded this species as *E. heterophylla*. Dressler (1962) studied "*E. heterophylla* L." and stated that the meaning of the epithet "*heterophylla*" refers to the shape of the leaves rather than to their colour; and "this species" includes two good species: *E. cyathophora* with stem and petioles glabrous or sparsely pilose; leaves glossy green; floral bracts usually basally red; glands broad, more or less bilabiate, the opening narrowly oblong; seed finely and sharply tuberculate; and *E. heterophylla* with stem and petiole often markedly pilose; leaves dull green; floral bracts green or basally pale, never basally red (often purple spotted); glands narrow, substipitate, the opening circular; seed coarsely and bluntly tuberculate, angular. According to this research and other recent work from the Old World (Radcliffe-Smith 1986, Lin & Hsieh 1991), the Chinese species of "*E. heterophylla*" includes two species, i. e. *E. heterophylla* and *E. cyathophora*.

Native of E USA and Mexico; introduced into cultivation and sometimes becoming naturalized in many parts of the Old World tropics, including most regions of China.

8. ***E. heterophylla*** L., Sp. pl. 453, 1753.

Syn. *E. taiwiana* S. S. Ying, Colour. Ill. Fl. Taiwan 2: 685, 1987 (Type: Taiwan, Ying s.n. NTUF).

Native of Tropical America, widely cultivated in the Old World, found in most regions, especially in S China.

For comments see the previous species.

9. ***E. hainanensis*** Croizat in J. Arnold Arbor. 21: 505, 1940.

Native to Hainan, China?

HOLOTYPE: Hainan, Loktung (Ledong), June 9, 1936, S. K. Lau 27036 (A!).

According to Boissier (1862) and Dressler (1962), the group of *Poinsettia* is native of the New World, but this species described by Croizat from hainan Is., China with 3 glands in the cyathium, undoubtedly is a member of subgen. *Poisenntia*. However, the limited information on the sheet of the holotype is insufficient to decide whether it is native to China or an escaped species from the New World.

10. ***E. dentata*** Michx., Fl. bor.-amer. 2: 211, 1803.

Native of E & S America and Mexico; naturalized recently in the grassland of the Botanic Garden in Beijing (Ma & Wu 1992b).

11. ***E. epilobiifolia*** W. T. Wang in Acta Bot. Yunnan. 10 (1): 46, 1988.

HOLOTYPE: Sichuan, Dukou, Dabaoding, alt. 1100-1300 m, secus rivos, fr. viridis, June 21, 1983, Exped. Qinghai-Xizang 83-11364 (ut 83-1364 by Wang). (PE! !iso KUN!).

The status of the species is completely similar to *E. hainanensis*, also an uncertain species as to its origin, since it is a member of *Poinsettia* of the New World with only one gland in the cyathium, but, described from China very recently.

Subgen. 4, ***Chamaesyce*** Raf. in Amer. Month. Mag. 2:119, 1817.
 Syn. *Chamaesyce* S.F. Gray, Nat. arr. Brit. pl. 2: 260, 1821.

Usually procumbent annuals; leaves stipulate, opposite, distichous, often asymmetrical at base; petiole; cyathia axillary or clustered, not in umbels; glands often with petaloid appendages; seeds without a caruncle.

TYPE: *Euphorbia supina* Raf. (fide Wheeler 1941) *E. maculata* L. (fide KOUTNIK 1987).

Native of the warmer parts of all continents including Australia, and reaching its greatest development in subtropical regions, especially in the New World.

Three sections (HURUSAWA 1954) and 18 species are recognized in China.

Sect. 1, ***Sclerophyllae*** (Boiss.) Hurusawa in J. Fac. Sci. Univ. Tokyo, Sect. Bot. 6: 275, 1954.

Syn. Sect. *Chamaesyce* subsect. *Sclerophyllae* Boiss. in DC Prodr. 15(2):12, 1862.

Subshrubs to shrubs or with maritime habitats; branches articulate; leaves leathery, rarely cordate at base; stipules united.

LECTOTYPE: *Euphorbia atoto* Forst. f.

4 species found in China (species 12-15).

KEY TO SECT. 1. *SCLEROHYLLAE*

1. Leave margin entire. 2
2. Leaves linear; root up to 30 cm 12, *E. lingiana*
2. Leaves elliptic to ovate; root less than 20 cm. 3
3. Leaves elliptic to ovate-oblong, obtuse or rounded at apex; glandular appendages narrowly elliptic, obscure 13, *E. atoto*
3. Leaves ovate, acute at apex; glandular appendages obvate to reniform, conspicuous ... 14, *E. sparrmanii*
1. Leave margin serrulate at least at apex, leaf-apex obtuse to rounded; glandular appendages conspicuous, wider than glands 15, *E. garanbiensis*

12. ***E. lingiana*** Shih ex W. Y. Chun in Acta Phytotax. Sin. 8: 276, 1963.
 Endemic to Shaping, Ledong, Hainan, China.
 TYPE: Shaping, Ledong, Hainan, Apr. 29, 1961 (ut Wanning, Hsinglung, Sept. 29, 1961 in original publication), Hainan Station 105, (IBSC!).
 From the available herbarium material, this may be allied to *E. bifida*.

13. ***E. atoto*** Forst. f., Fl. ins. austr. prodr. 36, 1786.
 From Indonesia and Australia to S China: Guangdong, Hainan and Taiwan.
 LECTOTYPE: Tahiti, Forster s.n.

14. ***E. sparrmanii*** Boiss., Cent. Euphor. 5, 1860.
 From the southern part of Japan to Australia, but only found in Lanyu Is. Taiwan, China.
 SYNTYPE: In India orientali, Sparrman s.n., Ins. Pitcairn, Abadie s.n., Ins. Mariannis, Gaudichaud s.n.

15. ***E. garanbiensis*** Hayata, Icon. Pl. For. 9: 103, 1920.
 Endemic to the Oluanpi Peninsula, the southernmost tip of Taiwan, China.
 TYPE: Oluanpi, Taiwan, Juna 1, 1912, Hayata s.n. (TI).

Sect. 2, **Hypericifoliae** Pojero, Fl. sicula 2 (2): 327, 1907.

TYPE: *Euphorbia hypercifolia* L. (fide Lin et al 1991).

6 species found in China (species 16-21).

Stem and branches ascending to suberect; cyathia cymulose.

KEY TO SECT. 2, *HYPERICIFOLIAE*

1. Capsule glabrous. 2
2. Leaves entire or obscurely repanded at margin, usually without petiole. 3
3. Leaves often with small purple spots; cyathia in cymes with leaf-like bracts. 16, *E. hyssopifolia*
3. Leaves without small purple spots; cyathia in cymes without leaf-like bract 17, *E. hypercifolia*
2. Leaves conspicuous serrulate at margin, with petiole, 1.5-2.5 mm long; cyathia in dense pedunculate cyme together with a solitary cyathium at node 18, *E. bifida*
1. Capsule pubescent. 4
4. Ray-leaves elliptic-lanceolate, 4 cm long, 2 cm wide, with conspicuously white margins 19, *E. marginata*
4. Ray-leaves without white margin. 5
5. Stem yellowish hirsute; leaf-like acute; glandular appendages narrowly obdeltoid 20, *E. hirta*
5. Stem glabrous; leaf-apex rounded; glandular appendages broadly reniform 21, *E. humifusa*

16. ***E. hyssopifolia*** L., Syst. Nat. ed. 10, 2: 1048, 1759.

Native to the New World and naturalized in C & S Taiwan, China (Lin et al. 1991).

17. ***E. hypercifolia*** L., Sp. pl. 454, 1753.

Syn. *E. indica* Lam., Encycl. Meth. Bot. 2: 423, 1788.

A native of the New World tropics, introduced into many parts of the Old World tropics and subtropics; found in S & SW China: Guangdong, Guangsi, Guizhou, Hunan, Jiangsi, Sichuan, Taiwan and Yunnan.

18. ***E. bifida*** Hook. & Arn., Bot. Capt. Beechey Voy 5: 213, 1837.

Syn. *E. serrulata* Reinw. ex Blume, Bijdr. 635, 1826 non Thuill 1790 nec. Vell. 1825.

E. vachellii Hook & Arn., l.c. 213, 1837 (Type: Guangdong, Vachell 241 E!).

From Australia to S China: Fujian, Guangdong, Guangsi, Guizhou, Hainan, Jiangsi, Jiangsu, Taiwan, Yunnan and Zhejiang.

TYPE: Guangdong, Vachell 240 (E!).

19. ***E. marginata*** Pursh, Fl. Amer. sept. 2: 607. 1814.

Native of N America, but cultivated and escaping in various parts of the Old World; for ornamental use cultivated in most provinces of China.

20. ***E. hirta*** L., Sp. pl. 454, 1753.

Syn. *E. pilulifera* L., l.c. 454, 1753.

Tropical and subtropical regions in both hemispheres; found in S & SW China: Guangdong, Guangsi, Guizhou, Hainan, Hunan, Jiangsi, Sichuan, Taiwan, Yunnan.

TYPE: India, Hb. 630/5-7 (LINN.).

21. *E. humifusa* Willd. ex Schlecht., Enum. pl. hort. berol. suppl. 27, 1814.
 Syn. *E. pseudochamaesyce* Fisch., Meyer & Ave-Lall., Ind. sem. hort. petrop. 9: 73, 1842
 (TYPE: hab. in Sibiria meridionali atque in Mongolia Chinesi.).
E. tashiroi Hayata, Icon. Pl. Formosa 9: 104, 1920 (TYPE: Taiwan, Tashiro s.n. TI!).
 Widely distributed in the temperate regions of Eurasia, found all over China.
 TYPE: not mentioned.

Sect. 3, *Chamaesyce*

TYPE: *Euphorbia maculata* L.

Stem and branches prostrate; cyathium solitary.
 8 species in China (species 22-29).

KEY TO SECT. 3, *CHAMAESYCE*

1. Capsule glabrous. 2
2. Leaves scaly, 3-5 mm long, 2-4 mm wide 22, *E. heyneana*
2. Leaves ovate to lanceolate, 5-10 mm long, 4-6 mm wide. 3
3. Leaf-margin errulate at least at apex, leaf-apex emarginate; glandular appendages obscure, narrower than glands 23, *E. taihsiensis*
3. Leaf-margin completely entire. 4
4. Glandular appendages conspicuous, reniform, entire 24, *E. serpens*
4. Glandular appendages obscure, narrowly elliptic, margin distinctly undulate 25, *E. makinoi*
1. Capsule pubescent. 5
5. Stem puberulent; ovary and capsule hirtellous mainly along their angles 26, *E. prostrata*
5. Stem sericeous or sparsely pilose; ovary and capsule pubescent all over. 6
6. Capsule about 1 mm long, not completely exserted at maturity; leaves green to reddish, obvate-oblong to oblong-lanceolate, 3-8 mm long, 2-5 mm wide 27, *E. thymifolia*
6. Capsule about 2 mm long, completely exserted at maturity. 7
7. Stem sericeous; leaves usually with an elongate purple spot centrally above; pollen trivolporate 28, *E. maculata*
7. Stem glabrous to sparsely pilose; leaves ovate to obvate-oblong, with several small purple spots above; pollen tetracolporate 29, *E. hsinchuensis*

22. *E. heyneana* Sprengel, Syst. veg. 3: 791, 1826.

Syn. *E. microphylla* Heyne ex Roth, Nov. pl. sp. 29, 1821, non Lam. 1788.

From Indonesia to Malesia, only found in S China: Fujian.

TYPE: India or., Heyne s.n.

23. *E. taihsiensis* (Chaw & Koutnik) Oudejans, World Cat. Euphorbiae & Geogr. Distr. 5, 1990.

Syn. *C. taihsiensis* Chaw & Koutnik in Bot. Bull. Acad. Sin. 31 (2): 163, 1990.

Endemic to Taihsi, Taiwan, China.

HOLOTYPE: Taihsi, Taiwan, Chaw 475 HAST.

24. *E. serpens* Kunth in H.B.K., Nov. gen. sp. 2: 52, 1815.

Native of America, recently naturalized in the western part of Taiwan.

25. **E. makinoi** Hayata in J. Coll. Sci. Imp. Univ. Tokyo 30 (1): 262, 1911.
Endemic to Philipines, Ryukiu and Taiwan.
HOLOTYPE: Taiwan, Tamsui, Makino s.n. Nov. 19, 1896, TI.
26. **E. prostrata** Ait., Hort. kew. 2: 139, 1789.
Native to tropical and subtropical America, introduced into many parts of the Old World; found in S China: Fujian, Guangdong, Hainan, Hubei, Jiangsu, Taiwan and Yunnan.
27. **E. thymifolia** L., Sp. pl. 454, 1753.
Syn. *E. sanguinea* auct. non Hochst. & Steud. ex Boiss.: Forb. & Hemsl. (1894).
Widely spread in warm countries of both hemispheres, found in S & SW China: Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangxi, Jiangsu, Taiwan and Zhejiang.
TYPE: India (?), Hb. LINN 630/10.
28. **E. maculata** L., Sp. pl. 455, 1753.
Syn. *E. supina* Raf., Amer. Month. Mag. 2: 119, 817.
Native of N America, naturalized in S & C China: Henan, Hubei, Jiangxi, Jiangsu and Zhejiang.
29. **E. hsinchuensis** (Lin & Chaw) C. Y. Wu & J. S. Ma in Acta Bot. Yunnan. 14 (4): 1992 (in press).
Syn. *C. hsinchuensis* Lin & Chaw in Bot. Bull. Acad. Sin. 32: 238, 1991.
Very recently described species from Hsinchu, Taiwan, China.
HOLOTYPE: Hsinchu, Taiwan, Lin, Chaw & Chou 444 HAST.
The species is much similar to *E. thymifolia* and *E. prostrata* according to the original description, but said to be distinguished from them by its tetracolporate pollen, which has never been reported as far as we know, as well as by its serrulate leaves, and sparsely pilose capsules. Since no material is available for study, we tentatively follow the original authors and include it here.

Subgen. 5, **Esula** Pers., Syn. pl. 14, 1806.

Usually erect herbs or sometimes shrubs at base; leaves exstipulate, usually alternate, symmetrical at base, sessile or subsessile; cyathia almost always in umbels; glands without petaloid appendages; seeds usually with a caruncle.

This subgenus, the largest one in the genus *Euphorbia*, is distributed all over the World, but centered in northern temperate regions, especially in Eurasia. The classification of this subgenus, especially at the section level, is much variable and confused. However, considering previous work from Eurasia (PROKHANOV 1949, HURUSAWA 1954, RECHINGER & SCHIMAN-CZEIKA 1964, TUTIN & RADCLIFFE-SMITH 1966, RADCLIFFE-SMITH 1982), the Chinese species may be grouped into the following 9 sections.

TYPE: *Euphorbia esula* L.

Sect. 4, **Lathyris** Dumort., Fl. belg. 172, 1827.

Biennial; caudine leaves decussate; capsule with spongy pericarp.

Only one species in this section (species 30).

TYPE: *Euphorbia lathyris* L.

30. **E. lathyris** L., Sp. pl. 457, 1753.

Widespread in America, Asia, Europe and N Africa. As for its origion there are several view points: BOISSIER (1862) has recorded it as occurring in China; TURCZANINOV (1878) treated it as probably a Chinese species; MAXIMOWICZ (1887) mentions it as an escaped one from cultivation in Japan (see FORBES & HEMSLEY, 1894); however, more recently RADCLIFFE-SMITH (1982) recognized it as probably native to C & E Mediterranean, widely naturalized in other places; now here known as cultivated species from Europe, and nearly all over the country.

SYNTYPE: France & Italy, Hb. 630/32 (LINN).

Sect. 5, **Helioscopiae** Dumort., Fl. belg. 172, 1827.

Glands 4, disciform, peltate inserted on the margin of cyathium; capsule ornamental.

As Dumortier's (1827) original concept, this section included only 4 species, but enlarged greatly by Tutin & Radcliffe-Smith (1966) and Radcliffe-Smith (1982). However, glands, the important character in the taxonomic treatment of the genus, is not used in their work. According to our point, the disciform glands, peltately inserted on the margin of the cyathium of *E. helioscopia* is much different from the others with the glands platiform, laterally inserted on the margin of the cyathium. In this way, the original concept of the section by Dumortier should be reevaluted. The other taxa placed in the section by Tutin & Radcliffe-Smith, however, should be considered as members of Sect. *Tithymalus* (see Sect. 7).

Only one species in this section in China (species 31).

TYPE: *Euphorbia helioscopia* L.

31. **E. Helioscopia** L., Sp. pl. 459, 1753.

Widespread in Eurasia and N Africa, introduced into N America; found in almost every province in this country.

TYPE: Europe, Hb. LINN. 630/49

Sect. 6, **Chylogala** (Prokh.) Prokh. in Fl. USSR 14: 384, 1949.

Syn. *Tithymalus* Subgen. *Chylogala* Prokh., Obz. Moloch. Sr. Azii 57, 1933.

Root linear; glands 5, transversely; cyathium with conspicuous twolobed segments.

A very poorly known section to C Asia, may be a separate one from Sect. *Tithymalus*. However, here we follow Prokhanov (1949) who separated it as a distinct section from the latter.

TYPE: *Euphorbia bungei* Boiss. (fide Prokhanov 1949).

3 species represented in China (species 32-34).

KEY TO SECT. 6, *CHYLOGALA*

1. Leaves ovate or oblong ovate, repanded at margins 32, *E. turkestanica*
1. Leaves deltiovate, rounded or lanceolate.
 2. Leaves deltiovate or rounded, dentate at margin 34, *E. schugnanica*
 2. Leaves linearilongirounded or lanceolate, emarginated at margin 33, *E. tibetica*

32. **E. turkestanica** Rgl., Descr. Pl. Nov. Fedtsch. 78, 1882.

Distribution: C Asia to NW China: Xinjiang.

SYNTYPE: In Turkestania prope Katti-Kurgan, inter Kossaral et Tschardara et inter Kossaral et Keles in desertis, O. Fedschenko s.n. (LE).

33. **E. tibetica** Boiss. in DC Prodr. 15 (2): 114, 1862.
From C Asia to W China: Xinjiang and Xizang.
SYNTYPE: India, Himachal Pradesh, Dankher, Thomson s.n. (K); Kinnaur, Jacquemot 1948 (G!); circa Leptel, Strachey & Winterbottom 6.
34. **E. schugnanica** B. Fedtsch. ex O. Fedtsch. & B. Fedtsch., Consp. Fl. Turkest. 6: 307, 1916.
Endemic to C Asia, now here is very poorly known from Wuqia Co., Xinjiang.
SYNTYPE: Schugnan, B. A. Fedtschenko s.n.; in valle inferiori fluvii Bogusch, Tuturin & Bessedin 111a.

Sect. 7, Tithymalus Duby, Bot. gall. 1: 412, 1828.

Mostly herbs; glands platiform, transversely ovate, not truncate, emarginate or with horns.

LECTOTYPE: *Euphorbia pallasii* Turcz.

14 species represented in China (species 35-48).

KEY TO SECT. 7, TITHYMALUS

1. Ray-leaves yellow to red, or sometimes with red pigment. 2
2. Ray-leaves yellow only, 5; raylet and raylet-leaves 3; glands 4, yellow 35, *E. sikkimensis*
2. Ray-leaves yellowish red, red or sometimes with red pigment. 3
3. Rhizome bore at the apex of linear root; leaves elliptic to obovate, sessile, with little purple above; glands 5 36, *E. stracheyi*
3. Rhizome near surface of the ground; leaves, usually obovate to elliptic, with red or reddish yellow above; glands 4 37, *E. sikkimensis*
1. Ray-leaves usually green, without conspicuous pigment. 4
4. Leaves repand or serrulate at least at apex. 5
5. Plant up to 50-70 cm high; leaves long lanceolate with conspicuous serrulate at margin; ray-leaf 3-4 38, *E. soongarica*
5. Plant 20-30 cm high; leaves long rounded or subsquare, repand at upper part; ray-leaf usually 2 39, *E. altotibetica*
4. Leaves entire. 6
6. Root linear, without rhizome. 7
7. Plant, 6-15 cm high; cyathium solitary 40, *E. monocyathium*
7. Plant more than 20 cm high, cyathia in cyme. 8
8. Plant 30-80 cm high; leaves oblanceolate, 6-10 cm long 1-2 cm wide; capsule sessile 41, *E. hyلونома*
8. Plant 20-30 cm high; leaves long linear, 4-6 cm long, 4-8 mm wide; capsule with peduncle up to 3-4 mm long 42, *E. kozlovi*
6. Rhizome conspicuous large. 9
9. Leaves ciliate at margin with broad nerve, cordate and amplexicaule at base 43, *E. blepharophylla*
9. Leaves glabrous at margin. 10
10. Plant up to 50-80 cm; leaves much larger up to 6-10 cm long, 2-4 cm wide; capsule 1-1.2 cm in diam 44, *E. wallichii*
10. Plants up to 30-50 cm; leaves 4-6 cm long, 5-15 mm wide; capsule less than 1.0 cm in diam. 11
11. Ray and ray-leaf 3-4. 12

12. Rhizome usually carrot, rhombic or conic; stem and leaves green . 45, *E. thomsoniana*
 12. Rhizome usually rapule; stem and leaves usually reddish or with pink pigment 46, *E. rapulum*
 11. Ray and ray-leaf 5. 13
 13. Stem without scaly-leaf at base; ovary and capsule glabrous or nearly glabrous 47, *E. kansuensis*
 13. Stem with scaly-leaf at base; ovary and capsule densely white pubescent 48, *E. pallasii*

35. ***E. sikkimensis*** Boiss. in DC. Prdr. 15(2): 113, 1862.

SYNTYPE: Sikkim; J. D. Hooker (K! Photo BNU!).

E. chrysocoma Levl. & Vaniot var. *glaucophylla* Levl. & Vaniot l.c., 6: 762, 1906 (Type: Yunnan, Ducloux 118 A!).

Endemic to SW China: Guangxi, Guizou, Hubei, Sichuan and Yunnan.

36. ***E. stracheyi*** Boiss. in DC Prodr. 15 (2): 114, 1862.

Syn. *E. megistopoda* Diels in Not. Roy. Bot. Gard. Edinb. 5: 218, 1912 (Type: Yunnan, Forrest 2237 E!).

E. bupleuroides Diels l.c. 5: 218, 1912 (Syntype: Yunnan, Forrest 224 E!, 4506 BM!, E!, 5008 BM!, E!).

E. mairei Levl. in Feddes Repert. 12: 286, 1913 (Type: Yunnan, Maire s.n. E!).

E. riae Pax & Hoffm. in Feddes Repert. Beih. 12: 433, 1922 (Type: Ost-Tibet, Limprecht 1801 B, WRSL, missing?).

E. shetensis Pax & Hoffm. l.c. 12: 433, 1922 (Type: Ost-Tibet, Limprecht 1739 B, WRSL, missing?).

E. mairei Levl. var. *luteociliata* W. T. Wang in Acta Bot. Yunnan. 10 (1): 40, 1988 (Type: Sichuan, Jiulong, Ying 4016 PE!).

Tithymalus himalayensis Klotzsch ex Klotzsch & Garcke, Bot. Ergebni. Reise Waldem. 115, pl. 20, 1862.

Widespread from Himalaya to W China: Kansu (S), Qinghai (S), Sichuan, Xizang & Yunnan.

The species varies from a very small plant up to 6-20 cm in alpine meadows to 30-80 cm in the plateau in SW China; for further comments see Ma & Wu (1992b).

SYNTYPE: Himalaya, Strachey & Winterbottom s.n. (K!); Kumaon, Strachey s.n.; Choor (Edgeworth 147) Sikkim, J. D. Hooker s.n. (K!); Kedarkanta, Jacquement 857.

37. ***E. griffithii*** Hook. f., Fl. Brit. Ind. 5: 259, 1887.

Syn. *E. bulleyana* Diels in Not. Roy. Bot. Gard. Edinb. 5: 219, 1912 (Type: Yunnan, Forrest 2231 E!).

E. cyanophylla Levl. in Feddes Repert. 12: 287, 1913 (Type: Yunnan, Maire s.n. E!).

E. erythrocoma Levl. l.c. 12: 287, 1913 (Type: Yunnan, Maire 210 E!).

E. rubriflora Levl. l.c. 12: 287, 1913 (Type: Yunnan, Maire s.n. E!).

E. porphyrastra Hand.-Mazz. in Anz. Akad. Wiss. Wien, Math.-Nat. KL. 62: 226, 1925 (TYPE: Yunnan, Handel-Mazzetti 6368, E!, W!, WU!).

E. seriocarpa hand.-Mazz., Symb. sin. 7 (2): 227, 1931 (Type: Yunnan, Handel-Mazzetti 3408 W!, WU!).

E. pseudosikkimensis auct. non (Hurusawa & Ya. Tanaka) A. R. Smith: (Hurusawa & Ya. Tanaka) Chin in C. Y. Wu, Fl. Xizang 3: 84, 1986.

Widespread from Himalaya to SW China: Sichuan, Xizang and Yunnan.

This species varies much in the colour of the bracts being from yellowish red to red (Ma & Wu 1992b).

TYPE: Bhutan, Griffith 963 (K!, photo BNU).

38. **E. soongarica** Boiss. Cent. Euphorb. 32, 1860.

Syn. *T. lamprocarpus* Prokh. in Obz. Moloch. Sr. Azii 105, 1933 (Type: Regione Jaxartica, distr. Tshimkent, Lipsky 4811).

From W Siberia to C Asia, found in NW China: kausu (W) and Xinjiang.

SYNTYPE: In Sibiriae Altaicae ad Tchingistan, C. A. Meyer s.n.; ad fl. Irtysch, Politow s.n.; prope Ajagus et Piket Agadyr, Schrenk s.n.

39. **E. altotibetica** O. Pauls. ex C. H. Ostenf. & O. Pauls. in Hedin, S. Tibet 6 (3): 56, 1922.

Syn. *E. przewalskii* Prokh. in Izv. Akad. Nauk. SSSR 1927: 198, 1927. (Syntypi: Kansu Przewalskii 19, LE; Tibet or et al.).

Endemic to W China: Kansu, Ningxia, Qinghai and Xizang.

HOLOTYPE: Eastern Tibet, Camp LXXII, Satju-tsangpo, near its outlet into Sellin-tso, Hedin s.n.

40. **E. monocyathium** (Prokh.) Prokh. in Fl. USSR 14: 338, 1949.

Syn. *T. monocyathium* Prokh. in Izv. Glavn. Bot. Sada SSSR 29: 552, 1930.

C Asia, Tianshan to NW China: Xinjiang (Kashi).

A. R. Smith (1986) regarded this species as a synonym of *E. thomsoniana* Boiss. According to our loan from LE, this species is much smaller than the latter; however, *E. tianshanica* Prokh. is a synonym of the latter (Ma & Wu 1991a).

TYPE: Sogdiana: Jugo Alaico, N. Desyatova.

41. **E. hylonoma** Hand.-Mazz., Symb. sin. 7 (2): 230, 1931.

Syn. *E. komaroviana* Prokh. in Fl. USSR 14: 343 et 734, pl. 18.2, 1949 (Type: USSR, Far East, Vladivostok, A. Schoschin 458).

E. fischeriana Steud. var. *komaroviana* (Prokh.) Chu in Liou, Fl. Pl. Chin. Bor. Orient. 6: 40, fig. 15: 5, 1977.

E. pilosa auct. non Linn.: Forb. & Hemsl. in Journ. Linn Soc. Bot. 26: 416, 1894.

From Far East of USSR via NE, N, C China to S and SW China: Anhui, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsi, Jiangsu, Jilin, Kansu, Liaoning, Shaansi, Shangdong, Shansi, Sichuan, Yuannana and Zhejiang.

HOLOTYPE: Hunan, Wukang, Apr. 1919, Wang T. U. 59 W!, WU!.

42. **E. kozlovi** Prokh. in Izv. Akad. Nauk. SSSR 1927: 200, 1927.

Syn. *E. kozlovi* Prokh. var. *angustifolia* S. Q. Zhou in Ma, Fl. Intramongol. 4: 48 et 207, 1979 (Type: Ningxia, Gou Z. Y. 0089, HIMC).

From Mongolia to N & NW China: Innermongol, Kansu, Ningxia, Qinghai, Shaansi and Shansi.

SYNTYPE: Mongolia centralis, P. Napalkov 57, June, 1909, LE; Mongolia borealis, V. Lissovski s.n.; kansu, P. Napalkov 120.

43. **E. blepharophylla** C. A. Meyer ex Ledeb., Icon. Pl. Fl. Ross. 4: 24, 1833-1834. C Asia via Siberia to NW China: Xinjiang.

TYPE: USSR, Hab. in locis rupestribus montium Arka-ul et Dolen-Kara deserti soonggoro-kirghisici trans fl. Kurstschum, Meyer s.n.

44. ***E. wallichii*** Hook. f., Fl. Brit. Ind. 5: 258, 1887.

Syn. *E. himalayensis* (Klotzsch ex Klotzsch & Garcke) Boiss. in DC Prodr. 15 (2): 113 (1862), Hook. f., Fl. Brit. Ind. (1887).

E. duclouxii Levl. & Vaniot in Feddes Repert. 6: 113, 1908 (Type: Yunnan, Ducloux 310 NY!).

E. luteo-viridis Long in Not. Roy. Bot. Gard. Edinb. 44 (1): 163, 1986 (Type: Sikkim, Cooper 160, E!).

E. yunnanensis A. Radcliffe-Smith in Kew Bull. 45 (3): 569, fig. 1, 1990 (Holotype: Yunnan, Dali, Sino-British Exped. to China 647 (K!); Paratypes: Yunnan, Forrest 2375 E!, 5956 BM!, E!, Maire 1073 BM!, E!).

From W Asia via Himalaya to SW China: Qinghai (S), Sichuan, Xizang and Yunnan.

SYNTYPE: Nepal, Wallich 7696A (K, photo BNU!); Kashmir, Chamba & Jammu, Aitchison s.n., Thomson s.n.!

For further comments see Ma & Wu (1992a).

45. ***E. thomsoniana*** Boiss. in DC Prodr. 15 (2): 113, 1862.

Syn. *E. tianshanica* (Prokh.) Popov in Bull. Soc. Natural. Moscou (Biol.), 47: 87, 1938.

T. tiansanicus Prokh. in Izv. Glav. Bot. Sada SSSR 29: 553, 1930 (Type: Tian-shan, jugo Kungei-Alatau, V. F. Brotherus 400).

From W Himalaya via Pamir to C Asia (Tianshan Mt.), found in W China: Qinghai (SW), Xinjiang and Xizang.

HOLOTYPE: Kashmir, Thomson s.n. (K!, photo BNU!).

46. ***E. rapulum*** Kar. & Kir. in Bull. Soc. Natural. Moscou 15: 448, 1842.

C Asia to NW China: Xinjiang.

TYPE: Hab. in argillosis Songoriae inter rivules Donsyk et Tschulak.

47. ***E. kansuensis*** Prokh. in Izv. Akad. Nauk. SSSR 1927: 203, 1927.

Syn. *E. yinshanica* S. Q. Zhou & G. H. Liu in Acta Phytotax. Sin. 27 (1): 77, 1989 (Type: Innermongol, S. Q. Zhou et al. 87001 NMFC!).

Endemic to C, N and NW China: Hebei, Hubei, Innermongol, Jiangsu (N), Kansu, Ningxia, Qinghai, Shaansi, Shansi and Sichuan.

SYNTYPE: Kansu, Przewalski 12, Apr. 18, 1880, LE!; Tibet or.

48. ***E. pallasii*** Turcz. in Bull. Soc. Natural. Moscou 11, 12: 1004, 1838, nom. transf.; Croizat in J. Arnold Arbor. 21: 492, 1940 in note.

Syn. *E. verticillata* Fischer in Mem. Soc. Natural. Moscou 3: 81, 1812 non Desfontaines 1804 nec. Poiret 1812, nec. Vellozo 1829, nec. Sprengel ex R. Sweet 1830, nec. Pallas ex Fischer & Meyer 1835.

E. fischeriana Steud., Nomencl. ed. 2, 611, 1840.

From Far East (USSR) and E Mongol to NE & N China: Heilongjiang, Innermongol, Jilin, Liaoning and Shandong.

TYPE: Sibiria (Dauria?), LE.

Sect. 8, *Tulocarpa* (Raf.) Prokh. in Fl. USSR 14: 347, 1949.

Syn. *Tithymalus* subgen. *Tulocarpa* Raf., Fl. Tellur. 4: 115, 1838.

Ovary and fruits with process or verrucose; glands transversely ovate or oblong, never with horns or truncate.

TYPE: *Euphorbia palustris* Linn. (fide Prokh. 1949).

14 species represented in China (species 49-61).

KEY TO SECT. 8, *TULOCARPA*

1. Raylet-leaf 2
2. Stem much branched at base 3
3. Stem woody at base; root up to 20-30 cm long; leaves emarginate at apex, narrowly at base 49, *E. pachyrrhiza*
3. Stem woody at base; root less than 20 cm long; leaves truncate at apex, cordate at base 50, *E. alpina*
2. Stem usually solitary; upper branches or not 4
4. Capsule 6 mm in diam., with long depressed verrucose 51, *E. macorrhiza*
4. Capsule less than 5 mm in diam., with rotunded verrucose 5
5. Capsule usually sparsely verrucose; leaves usually 8-10 cm long, narrowly at base 52, *E. altaica*
5. Capsule usually densely verrucose; leaves more than 10 cm long 6
6. Verrucose short and depressed; glands entire 53, *E. regina*
6. Verrucose long and rounded; glands repand at margin 54, *E. jolkinii*
1. Raylet-leaf 3 or 3 to 4 7
7. Plants up to 50-80 cm high 8
8. Leaves lanceolate, very dense; plants subglabrous or subescent 55, *E. pekinensis*
8. Leaves ovate or obovate, veru sparsely; plants in pilose 56, *E. pilosa*
7. Plants less than 50 cm high 9
9. Ovary and capsule with minute tubercles 57, *E. heishuiensis*
9. Ovary and capsule verrucose 10
10. Ovary and capsule verrucose along their angles only 58, *E. lucorum*
10. Ovary and capsule verrucose all over or smooth along their grooves 12
12. Leaves 3-5 mm wide, acuminate at apex 59, *E. micractina*
12. Leaves 6-8 cm long 5-10 mm wide, rounded at apex 60, *E. donii*
11. Ovary and capsule verrucose all over including their grooves 13
13. Ray and ray-leaf 3; stem herbaceous, villose, thickened 61, *E. shouanensis*
13. Ray and ray-leaf 3-4; stem subshurb at base, hirsute 62, *E. formosana*

49. ***E. pachyrrhiza*** Kar. & Kir. in Bull. Soc. Natural. Moscou 14: 745, 1841.

C Asia, Tianshan Mt. to NW China: Xinjiang.

TYPE: Hab. in rupestribus montium Aktschavly; in montibus Tarbagati.

50. ***E. alpina*** C. A. Meyer ex Ledeb., Icon. Pl. Fl. Ross. 2: 26, 1830.

W Siberia to E Siberia, found in NW China: Xinjiang (Altai).

TYPE: Hab. in alpinis montis Crucis prope Riddersk, Ledebour s.n.

51. ***E. macorrhiza*** C. A. Meyer ex Ledeb., Icon. Pl Fl. Ross 2: 26, 1830.

W Siberia to C Asia, found in NW China: Xinjiang (Altai).

TYPE: Kazakstan, the vicinity of Ridder and Ust-Kamenogorsk, Ledebour s.n.

52. ***E. altaica*** C. A. Meyer ex Ledeb., Icon., Pl Fl. Ross. 2: 26, 1830.

W Siberia & Altai, found at NW China: Xinjiang (Altai).

Several poor specimens in our research may macht this species, and further study, however, is needed.

TYPE: Hab. in locis montosis ad fl. Tscharysch, Ledebour s.n.

53. ***E. regina*** Levl. in Bull. Acad. Geogr. Bot. 24: 145, 1914.

Syn. *E. nematocypha* Hand.-Mazz. in Anz. Akad. Wiss. Wien, Math.-Nat. Kl. 63: 9, 1926 (Holotype: Yunnan, Handel-Mazzetti 3125 W!, WU!).

E. nematocypha Hand.-Mazz. var. *induta* Hand.-Mazz., Symb. sin. 7 (2): 230, 1931 (Type: Yunnan, Maire s.n. A!, NY!).

E. jolkinii auct. non Boiss.: Forb. & Hemsl. in J. Linn. Soc. Bot. 26: 415, 1894.

Endemic to SW China: Sichuan and Yunnan.

TYPE: Yunnan, Dongchuan, Maire s.n. E!.

54. ***E. jolkinii*** Boiss., Cent. Euphorb. 32, 1860.

Endemic to E Asia, found in S China: Taiwan.

SYNTYPE: Japan, Jolkin s.n.; Zolling 512.

55. ***E. pekinensis*** Rupr. in Maxim., Primit. fl. amur. 239, 1859, in nota.

Syn. *E. lasiocaula* Boiss. in DC Prodr. 15 (2): 1266, 1866 (Type: Japonia, Herb. Mus. Bat.).

E. sampsonii Hance in Ann. Sci. nat. ser. 5, Bot. 5: 240, 1866 (Type: Guangdong, Sampson 11422 BM!).

E. cavaleriei Levl. & Vaniot in Bull. Herb. Boiss. ser. 2, 6: 762, 1906 (Type: Guizhou, Cavalerie 2141 E!).

E. labbei Levl. in Feddes Repert. 12: 537, 1913 (Type: Guizhou, Cavalerie 3956 E!).

E. sinensis Jesson . Turr. in Kew Bull. 1914: 329, 1014 (Type: NW China, near Lanzhou, Purdom K), non Safford (1905).

E. lanceolata T. N. Liou in Contrib. Lab. Bot. Nat. Acad. Peiping 1 (1): 5, 1931 (Type: Zhejiang, K. K. Tsoong s.n. PE), non. Sprengel 1807 nec Heyne ex Roth 1821 nec Philippi 1895 nec Larranaga 1923.

E. barbellata Hurusawa in J. Jap. Bot. 16: 571, 1940 (Type: NE China, "Kwantung Prov.", M. Nishimura s.n. TI), non. G. Engelmann 1858.

E. imaii Hurusawa in J. Jap. Bot. 16: 576, 1940 (Type: Jilin, Heinan, H. Imai s.n. TI).

T. tchen-ngei Sojak in Cas. Nar. Muz. Praha, 140 (3-4): 177, 1972.

E. tchen-ngei (Sojak) A. Radcliffe-Smith in Kew Bull. 36 (2): 216, 1981.

E. hurusawae Oudejans in Phytologia 67 (1): 46, 1989.

E. hurusawae Oudejans var. *imaii* (Hurusawa) Oudejans l.c. 67 (1): 46, 1989.

E. jesonii Oudejans, World Cat. Euphorbieae & Geogr. Distr. 5, 1990.

Distribution all over China except. Taiwan, Xinjiang and Xizang.

TYPE: N. China, Kuznov, LE.

56. ***E. pilosa*** L., Sp. pl. 460, 1753.

W Siberia to E Siberia and Mongol, found in NW China: Xinjiang (N).

TYPE: W Siberia.

57. ***E. heishuiensis*** W. T. Wang in Acta Bot. Yunnan. 10 (1): 42, 1988.

Endemic to W China: Kansu (S) and Sichuan.

TYPE: Sichuan, Heishui Co., Exped. Pl. Ecol. Heishui, 1162 (PE!).

58. ***E. lucorum*** Rupr. in Maxim., Primit. fl. amur. 239, 1859.

Far East of USSR, Korea and NE China: Heilongjiang, Intermongol, Jilin and Liaoning.

SYNTYPE: Am südlichen Amur: bei Kinneli; unterhalb Gaidje, Maack s.n.; Bureja-Gebirge, V. Ditmar s.n.; am Ussuri: bei Agdiki, sine collect.

59. ***E. micractina*** Boiss. in DC Prodr. 15 (2): 127, 1862.

Syn. *E. tagunica* Prokh. in Izv. Akad. Nauk. SSSR 1927: (Type: Kansu, Przewalski 73, June 6, 1873, LE!).

E. lucorum Rupr. var. *parvifolia* H. L. Yang in D. Ma, Fl. Ningxia 1: 428, f. 417, 1986 (Type: Ningxia, D. Ma 1-0065).

E. villifera W. T. Wang l.c. 10 (1): 42, 1988 (Type: Kansu, Zhouqu, Jiang & Jin 361 PE!), non Scheele 1849.

E. wangii Oudejans in Phytologia 67 (1): 49, 1989.

E. altaica auct. non C. A. Meyer: Forb. & Hemsl. in J. Linn. Soc. Bot. 26: 411, 1894.

From Kashmir to W China: Henan (W), Kansu, Ningxia, Qinghai, Shaansi, Shansi, Sichuan, Xinjiang and Xizang.

HOLOTYPE: Kashmir, Jaquement 558 (P!), isotypus (A!).

60. ***E. donii*** Oudejans in Phytologia 67 (1): 45, 1989.

Syn. *E. longifolia* D. Don, Prodr. fl. nepal. 62, 1825 non Lam. 1788.

Endemic to Himalaya, found in SW China: Xizang (S).

HOLOTYPE: Nepal, Hamilton s.n.

61. ***E. shouanensis*** H. Keng in J. Wash. Acad. Sci. 41: 205, 1951.

Endemic to S China: Taiwan.

TYPE: Taiwan, Chayee (Jiayi), Suzuki 20910, Nov. 10, 1940, (TAI).

As judged from the limited material, it may be allied to *E. formosana* & *E. jolkinii*.

62. ***E. formosana*** Hayata in J. Coll. Sci. Imp. Univ. Tokyo 30 (1): 262, 1911.

Syn. *E. calonesiaca* Croizat in J. Arnold Arbor. 19: 97, 1938 (Holotype: Taiwan, Taizhong, Satake s.n. TI).

E. orientalis auct. non L., Hayata in J. Coll. Sci. Imp. Univ. Tokyo 20: 70, 1904.

For further comments on this species, see Croizat (1938) and Lin & Hsieh (1991).

Endemic to Taiwan, China.

TYPE: Taiwan, Tubghsing, Miyake s.n. TI!

Sect. 9, **Paralias** Dumort., Fl. belg. 172, 1827.

Annual or perennial: leaves fleshy alternate, palmately veined; capsule with indurated mesocarp; seeds ornamented or smooth.

TYPE: *Euphorbia paralias* L. (fide: Dumortier 1827).

Two species found in W China (specie 63-64).

KEY TO SECT. 9, **PARALIAS**

1. Leaves more than 13 mm long, less than wide; seeds smooth 63, *E. seguieriana*
1. Leaves less than 12 mm long, 3-5 mm wide; seeds sparsely with pits 64, *E. humilis*

63. ***E. seguieriana*** Neck. in Hist. Comment. Acad. Sci. Theodoro-Palatinæ 2: 493, 1770.

Europe to C Asia, distributed in W China: Xinjiang.

A very imperfect specimen may be similar to this species. Obviously, it needs further study.

64. ***E. humilis*** C. A. Meyer ex Ledeb., Icon. Pl. Fl. Ross. 2: 25, 1830.

C Asia (USSR) to NW China: Xinjiang (W).

TYPE: Xinjiang, Soongar, Meyer s.n. LE.

Sect. 10, **Wentsai** Ma & Wu, *sect. nov.*

Sectionis cyathii bracteolis inter flores stamineos nullis; glandulis basi concavis obliquissime corniculatis valde insignis.

TYPE: *Euphorbia yanjinensis* W. T. Wang.

This section, a very interesting taxon, having the glands oblique infundiluriform, represents a new section as Wentsai Wang pointed out (W. T. Wang 1988).
Two species endemic to China (species 65-66).



Fig.2.—*Euphorbia tongchuanensis* Wu & Ma.: 1, plant; 2, cyathium ($\times 6$); 3, back of gland ($\times 10$); 4, inside of gland ($\times 10$). After C. L. Xiao 961 (holotype).

KEY TO SECT. 10, *WENTSAI*

1. Leaves obovate 6-8 cm long, 2-3.5 cm wide; glandular vein conspicuous 65, *E. yanjinensis*
1. Leaves longilinéar 8-10 cm long, 5-8 mm wide; glandular vein obscure 66, *E. tongchuanensis*
65. ***E. yanjinensis* W. T. Wang** in Acta Bot. Yunnan. 10 (1): 45, f.3, 1988.
Endemic to SW China: Yunnan.
TYPE: Yunnan, Yanjin, Apr. 30, 1974, sin. nom. collect. et numero (KUN!).
66. ***E. tongchuanensis* C. Y. Wu & J. S. Ma, sp. nov.** (Figure 2).

Afinnis E. yanjinensis W. T. Wang, sed foliis oblanceolatis; nervulo glanduli obscuris differt.
Herba perennis. Caules 15-25 cm alti, glabri. Folia papyracea sessilia vel subsessilia, oblanceolata, 6-10 cm longa, 3-5 mm lata, apice rotunda, basi angustata, margine integra, glabra; Costa dorsor prominula, nervis lateralibus utrinsecus 4-6 incospicuis. Umbella circ. 8 cm diam., ramosa solitaria; bracteae umbellares 2, ovatae vel triovatae, 5-6 mm longae 4-5 mm latae, apice rotundatae, basi truncato-cordatae, cyathia cyathiforma, circ. 3 mm longa, ore 2.5 mm diam., extus intusque glabra, lobis oblongis circ. 0.2 mm longis, integris, bracteolis interflores staminibus nullis; Glandulae 4, breviter lateque stipitatae, obliquissime infundibuli-formes, ventre humiles, circ. 0.2 mm altae, cornibus 0.4-0.6 mm longis, glabrae. Flores staminei glabris, flores pistillati glabrii; ovarium subglobosum, dense puncticulatae, glabrae; styli 3, a basi fere ad medium connati, apice 2-lobulat. Capsule ignotae.

TYPE: China: Shaansi, Tongchuan Co., Xiao C. L. 961 (Holotypus, PE).

This species is much similar to *E. yanjinensis* W. T. Wang but differs by its oblanceolate leaves, glandular veins incospicuous.

Sect. 11, ***Cymatosperum* (Prokh.) Prokh.** in Fl. USSR 14: 459, 743, 1949.

Syn. *Tithymalus* sect. *Cymatosperum* Prokh. Obz. Moloch. Sr. Azii 151, 1933.

Annuals; cauliné leaves opposite; glands with horns; capsule with indurated mesocarp; seeds ornamented.

TYPE: *Euphorbiae falcata* L. (fide Prokh. 1949).

5 species found in China (67-71).

KEY TO SECT. 11, *CYMATOSPERMUM*

1. Leaves linear or lanceolate. 2
2. Leaves densely linear or linear-lanceolate, 2-4 cm long, 5-10 mm wide; plants usually 30-50 cm high 68, *E. dracunculoides*
2. Leaves sparsely linear, 1-2 cm long, 1-5 mm wide; plant usually less than 20 cm high.
3. Leaves than 1-2 mm wide; seed with caruncle 69, *E. franchetii*
3. Leaves 3-5 mm wide; seed without caruncle 70, *E. inderiensis*
1. Leaves ovate or obovate. 4
4. Leaves ovate, 3-4 cm long, 5-10 mm wide at base, acuminate at apex; plant up to 15 cm high 67, *E. turczaninowii*

4. Leaves obovate, 2-3 cm long, 5-10 mm wide, dentate at apex; plant up to 20-30 cm high 71, *E. peplus*
67. ***E. turczaninowii*** Kar. & Kir. in Bull. Soc. Natural. Moscou 15: 447, 1842.
C Asia to Chinese Songar: Xinjiang (N).
TYPE: Hab. in Songoriae collibus sabulosis inter fontem Sassyk-pastace et montes Arganay.
68. ***E. dracunculoides*** Lam., Encycl. Meth. Bot. 2: 428, 1788.
N Africa, S Europe, W & C Asia to China: Yunnan.
HOLOTYPE: Mauritius, P. Commerson 545 (P-LA).
69. ***E. franchetii*** B. Fedtsch. in O. & B. Fedtsch., Consp. Fl. Turkest. 6: 310, tab. 9, 1916.
Distribution: China: Xinjiang (W), Afghanistan (N) and Turcomania.
TYPE: Teng-i Charam, Bouchara, Capus s.n. P.
70. ***E. inderiensis*** Less. ex Kar. & Kir. in Bull. Soc. Natural. Moscou 15 (2): 448, 1842.
C Asia to Chinese Soongaria: 1949.
As for its type information, we have get two records as following: Xinjiang. Chinese Soongar, Xinjiang (N), LE (by Prokhanov 1949).
TYPE: USSR, Kazakhstan, L. Inter, Lessing s.n. B (by A. Radclikke-Smith 1986).
71. ***E. peplus*** L. Sp. pl. 456, 1753.
Native of Macaronesia, Europe, N Africa and S, W & C Asia; introduced in S, SE & Asia, Australia and N & C America; found only in S & SW China: Fujian (Amoy, Fuzhou), Guangdong (Hongkong), Guangxi (Nanning), Yunnan (Kunming).
TYPE: Europe, Hb. LINN. 630/24

Sect. 12, ***Esula***

Perennials; caudine leaves alternate, pinnately veined; Glands truncate or with horns; capsules with indurated pericarp; seeds smooth.

TYPE: *Euphorbia esula* L.

6 species represented in China (species 72-77).

KEY TO SECT. 12, ***ESULA***

1. Glands not dentate at apex. 2
2. Leaves linear, long-linear, linear-lanceolate, lanceolate or oblanceolate, 2-6 cm long, 2-11 cm wide 72, *E. prolifera*
2. Leaves ovate, obovate, oblong-obovate, 5-10 cm long, 1-2 cm wide. 3
3. Leaves long not as three times as wide, more than 1 cm wide. 4
4. Plants pubescent: glands with two obscure horns 73, *E. latifolia*
4. Plants glabrous; glands with two conspicuous horns 74, *E. sieboldiana*
3. Leaves long more than 3 times as wide, less than 1 cm wide. 5
5. Root linear; plants with sterile branches 75, *E. esula*
5. Root moniliform; plants without sterile branches 76, *E. kansui*
1. Glands dentate at apex; leaves linear to lanceolate 77, *E. lioui*

72. ***E. prolifera*** Buch.-Ham. in D. Don, Prodr. fl. nepal. 62, 1825.
 Syn. *E. nepalensis* Boiss. in DC Prodr. 15 (2): 157, 1862 (Syntypes: India, Punjab, Thomson, s.n., Royle s.n.; Madden, s.n.; Edgeworth s.n.; Kumaon, Strachey s.n.; Nepal, Wallich 7698A).
E. pinus Levl. in Feddes Repert. 11: 296, 1912 (Type: Guizhou, Cavalerie 3779 A!).
 E Himalaya to SW China: Guizhou, Sichuan and Yunnan.
 TYPE: Nepal, Buchanan-Hamilton, s.n. MB.
73. ***E. latifolia*** C. A. Meyer ex Ledeb., Icon. Pl. Fl. Ross. 2: 25, 1830.
 W Siberia, C Asia to NW China: Xinjiang (N).
 SYNTYPE: USSR, Kazakhstan, Meyer s.n., Ledebour s.n.
74. ***E. sieboldiana*** Morr. & Decne. in Bull. Acad. Brux. 3: 174, 1836.
 Syn. *E. hippocrepica* Hemsl. in J. Linn. Soc. Bot. 26: 414, 1894 (Syntypes: Hubei, Henry 7853 S!, 7867 K!).
E. henryi Hemsl. l.c. 26: 413, 1894 (Syntypes: Hubei, Henry 3429 BM!, 3429 P!).
E. erytharea Hemsl. l.c. 26: 412, 1894 (Syntypes: Hubei, Henry 1261 K!, 1275 K!, 3432 K!).
E. bodinieri Levl. & Van. in Bull. Herb. Boiss. ser. 2,6: 761, 1906 (Type: Guizhou, Bodinier s.n. E!).
E. esquirolii Levl. & Van. l.c. 6: 762, 1906 (Type: Guizhou, Cavalerie 1321, E!).
E. glaucopoda Diels in Not. Roy. Bot. Gard. Edinb. 5: 219, 1912 (Type: Yunnan, Forrest 962 E!).
E. savaryi Kiss in Bot. Kozl. 19: 91, 1921 (Type: Sibiria or., Far East).
E. szechuanica Pax & Hoffm. in Feddes Repert. Baih. 2: 433, 1922 (Type: Sichuan, Limprecht 1429, B or WRSI, missing?).
E. luticola Hand.-Mazz., Symb. sin. 7 (2): 233, 1931 (Type: Yunnan, Handel-Mazzetti 10138, A!, W!, WU!).
E. kangdingnsis W. T. Wang in Acta Bot. Yunnan. 10 (1): 43, 1988 (Type: Sichuan, Liu 721, PE!).
E. kangdingnsis W. T. Wang var. *puberula* W. T. Wang l.c. 10 (1): 45, 1988 (Type: Sichuan, LI 75470 PE!).
E. rothiana auct. non Spreng: Hand.-Mazz., l.c. 7 (2): 234, 1931.
E. oreophila auct. non Miq.: Lauener in Not. Roy. Bot. Gard. Edinb. 40: 480, 1983.
 From Japan to all over China, except Fujian, Hainan, Innermongol, Qinghai, Taiwan, Xinjiang and Xizang.
 TYPE: Japan, in Brussels (fide Prokhanov 1949).
75. ***E. esula*** L., Sp. pl. 461, 1753.
 Syn. *E. virgata* Waldst. et Kit., Descr. Icon. pl. rar. hung. 2: 176, 1805 (Lectotype: Chrtek & Shodropolova 1982).
E. uralensis Fisch. ex Link, Enum. hort. berol. alt. 2: 14, 1822 (Type: Hab. in montibus Uralensibus).
E. subcordata C. A. Meyer ex Ledeb., Icon. Pl. Fl. Ross. 2: 25, 1830 (Type: Hab. in montium Dolen-Kara, Meyer s.n.).
E. lunulata Bunge, Enum. pl. Chin. bor. 59, 1833 (Type: Beijing, LE!).
E. gmelinii Steud., Nomecl. ed. 2, 1: 612, 1840 (Type: Sibiria, Gmelin).
E. discolor Ledeb., Fl. Ross. 3: 577, 1851 (Type: Sibiria baikal. Irkutzk, Kruhse s.n.).
E. mandshurica Maxim. in Bull. Acad. Sci. St. Petrop. 29: 203, 1883 (Type: NE China, LE!).
E. kaleniczenkii Czern., Konspekt' Rast. Khar'kova 55, 1859 (Type: Hab. in Rossia merid.).
E. tarokoensis Hayata, Icon. Pl. Formosa 7: 34, 1918 (Type: Taiwan, hayata & Sasaki s.n. TI!).

T. jaxarticus Prokh., Obz. Moloch. Sr. Azii 192, 1933 (Type: Tian-shan, Vvedensky 307).
T. glomerulans Prokh., ibid. 183, 1933 (Type: Sogdiana, A. Golbeck 89).

E. minxianensis W. T. Wang in Acta Bot. Yunnan 10 (1): 43, 1988 (Type: Kansu, Minxian, Jiang & Chin 472 PE!).

Native of Eurasia, introduced to America, found all over China except Guizhou, Hainan, Yunnan and Xizang.

TYPE: W Europe, LINN?

76. ***E. kansui*** Liou ex S. B. Ho in Fl. tsiling. 1 (3): 162 et 450, 1981.

Endemic to C & N China: Henan, Kansu, Ningxia and Shaansi.

TYPE: Shaansi, Zhouzi, K. T. Fu 8186 WUK.

77. ***E. lioui*** C. Y. Wu & J. S. Ma in Acta Bot. Yunnan. 14 (4): (in press).

A very interesting species, dentate at margins of glands, which obviously never was found in China: Innermongol.

TYPE: Innermongol, Alashan-Meng, Liu Y. H. et Yang X. L. 790005, LZDI (Herbarium, Department of Botany, Lanzhou Desert Institute, Academia Sinica!).

EXCLUDED SPECIES

1. ***Euphorbia liukiuensis*** Hayata, Icon. Pl. Formosa 9: 103, 1930.

Described from Liukiu (E 123.00, N 24.27) formerly under Taiwan, now belongs to Japan.

2. ***Euphorbia lucidissima*** Levl. & Vaniot in Bull. Herb. Bois. ser. 2, 6: 763, 1906 = *Canscora lucidissima* (Levl. & Vaniot) Hand.-Mazz., Symb. sin. 7: 234, 1931; Lauener in Not. Roy. Bot Gard. Edinb. 40 (3): 481, 1983.

UNCERTAIN CHINESE SPECIES

1. ***Euphorbia consanguinea*** Schrenk. ex Fisch. & Meyer, Enum. pl. nov. 1: 88, 1841.

TYPE: In Songariae montibus Arganaty, Schrenk s.n.

In the original description, the seed of this specie does not have a caruncle, but all the specimens from this country have the seeds with a caruncle.

Distribution in N Iran (Rechinger & Schiman-Czeika 1964).

2. ***Euphorbia alatavica*** Boiss., Cent. Euphorb. 33, 1860.

SYNTYPES: Soongar, Alatau, Karelin & Kirtilow 1945; Schrenk s.n. (see nest species).

3. ***Euphorbia buchtormensis*** C. A. Meyer ex Ledeb., Ic. Pl. Fl. Ross. 2: 26, 1830.

TYPE: C Asia, Meyer s.n.

For these 2 species mentioned in the claves of Xinjing (Yang 1983), we have not seen any specimen from this country at present.

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