
Research Article

The occurrence of *Croton bonplandianus* in Java and a new record of *Caperonia palustris* for Malesia Region

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Abstract

Two noteworthy species belongs to the Euphorbiaceae, namely *Caperonia palustris* and *Croton bonplandianus*, have been recently collected from Java Island, West Malesia. The discovery of *C. palustris* is a new record for Malesia region, while *C. bonplandianus* is considered as a newly recorded alien species to the Flora of Java. *Caperonia palustris* is characterized by the glandular and non-glandular hairs on its stem and petiole, triangular to lanceolate or subulate stipules, and leaves in ovate-oblong or elliptic-oblong to lanceolate shape. *Croton bonplandianus* differs from the previously reported species in Java, *C. hirtus*, by its non-irritating hairs on the stem, sessile basal leaf glands, leaf margin with simple serration, and ellipsoid fruit. Descriptions and a brief discussion are given.

Keywords: *Caperonia*, *Croton*, Euphorbiaceae, Java, Malesia

Introduction

According to the classification system proposed by the Angiosperm Phylogeny Group, Euphorbiaceae *s.l.* has been separated into Euphorbiaceae *s.s.*, Phyllanthaceae, Peraceae, Picrodendraceae, Pandaceae and Putranjivaceae (APG IV, 2016). Euphorbiaceae *s.s.* is the largest segregate family and mainly distributed in the tropics. The family comprises 225 genera and more than 6,300 species in the world (Challen, 2015).

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Morphologically, the family has a superior ovary, then usually 3-locular with a single ovule per locule, and the fruit usually a dehiscent schizocarp with persistent central columella (Byng, 2014; Challen, 2015).

The information on the Euphorbiaceae *s.l.* in Malesia have been proposed by P.C. van Welzen (van Welzen, 2020). Euphorbiaceae *s.s.* consists of 81 genera to the Flora Malesiana treatment (van Welzen, 2020). Some of them are introduced genera, such as *Hevea* Aubl., *Jatropha* L., *Manihot* Mill., and *Ricinus* L. (van Welzen et al. 1997; van Welzen, 1998; Sam & van Welzen, 2004; van Welzen et al., 2017). Van Welzen & Fernández-Casas (2017) reported a genus new to Malesia, namely *Cnidoscolus* Pohl, from the Philippines. Moreover, a new genus, namely *Weda* Welzen, was recently discovered in Halmahera, North Maluku, Indonesia (van Welzen et al., 2020). Some novelties on species-level also have been made by some authors, including new species discovery (Setiawan et al. 2020) or new record (Mustaqim et al. 2019). On the other hand, the taxonomic studies also have shown the presence of new novelties for the non-native species such as Van Welzen & Fernández-Casas (2017), who reported the occurrence of *Cnidoscolus* Pohl in the Philippines and Irsyam et al. (2019) who reported two species of *Euphorbia* from Java. Other genera have not been reported in that treatment, especially the introduced plants.

Based on the Flora of Java vol. I, there are 43 genera and 114 species of Euphorbiaceae *s.s.* in Java (Backer & Bakhuizen van den Brink, 1963). Djarwaningsih (2012; 2013) has reported several newly recorded species from the island, namely *Balakata baccata* (Roxb.) Esser., *Endospermum diadenum* (Miq.) Airy Shaw, and *Suregada glomerulata* (Blume) Baill. Irsyam et al. (2019) reported two newly naturalized *Euphorbia* species from Bogor (West Java), namely *E. graminea* Jacq. and *E. hyssopifolia* L. In this paper, we formally report the occurrence of two non-native species from Java Island named *Caperonia palustris* (L.) A.St.-Hil., represents the first record of the genus for Malesia, and *Croton bonplandianus* Baill.

Materials and Methods

In this study, the specimens were collected during field explorations to Bogor, Bekasi, and Indramayu in West Java as well as Rembang in Central Java from April to December 2019. Plants were collected according to the guideline in van Balgooy (1987) and preserved as dried herbarium specimens. The descriptions and botanical illustrations were made based on the dried material and field

notes on living characters. A further examination was conducted in order to confirm the identity of specimens in Herbarium Bogoriense (BO), Herbarium Bandungense (FIPIA), and Herbarium of Department of Silviculture, The Faculty of Forestry, IPB University. Moreover, the examination was also supplemented by images from L (bioportal.naturalis.nl), G (ville-ge.ch/musinfo/bd/cjb/chg/), and P (science.mnhn.fr/institution/mnhn/collection/p/list) (acronym follow Thiers 2020-continuously updated) as well as JSTOR Global Plants (plants.jstor.org).

Result and Discussion

Caperonia palustris (L.) A. St.-Hil., Hist. Pl. Remarq. Bresil 3/4: 245. 1825; Grisebach, Fl. Brit. West Ind. 43-44. 1864; Brown, Hutchinson & Prain, Fl. Trop. Africa VI: 832. 1913; Standley & Dahlgren, Fl. Costa Rica 18, 2: 601-602. 1937; Standley & Steyermark, Fl. Guatemala 24, VI: 56-57. 1949; Macbride, Fl. Peru 13, 3A: 1. 97. 1951, Webster & Burch, Ann. Missouri Bot. Gard. 54(3): 268. 1967; Burger & Huft, Fl. Costaricensis 36: 70. 1995; De Egea et al., PhytoKeys 9: 79. 2012; *Argythamnia palustris* (L.) Kuntze, Revis. Gen. Pl. 2: 594. 1891. – Basionym: *Croton palustris* L., Sp. Pl. 2: 1004. 1753 ('*palustre*'). – Type: Cristina, Izabal, S.F. Blake 7475 (neotype?).

Herb to sub-shrub, woody at base, monoecious, erect, up to 60 cm tall, with milky latex. **Stem** erect, cylindrical, ridged, green; indumentum consisting of glandular and non-glandular hairs, c. 1 mm long. **Leaves** simple, alternate; petiole slender, 4-20 mm long, green, glandular hairs present; lamina ovate-oblong, elliptic-oblong to lanceolate, 5-12 × 2-5 cm, base rounded to acute, margin serrate, apex acute, acuminate or obtuse, secondary venation pinnate, regularly spaced, forming acute angle of c. 25° with midrib, 8-12 pairs, trinerved at base, marginal glands on leaf teeth and adaxial basal glands absent. **Stipules** triangular to lanceolate or subulate, 2-5 × c. 1 mm, caducous. **Inflorescence** racemose thyrse, axillary, 6-8 cm long, flowers unisexual, 1-4 proximal pistillate flowers, several distal staminate flowers; peduncle 2.3-4.3 cm long, hispid; bracteole ovate, c. 1 mm long. **Staminate flowers**: c. 1.5 mm wide; pedicels c. 1 mm long; sepals 5, united at base, ovate-elliptic, c. 1 × 0.5 mm, glabrous, green; petals 5, free, obovate-oblong, c. 1 × 0.5 mm long, white, glabrous, clawed, disc absent; stamens 10, unequal in size; filaments united near the base into a column, free distally, filiform, white; anthers oblong, yellowish; pistillode present, minute, cylindrical. **Pistillate flowers**: c. 1.5-2 mm wide; sub-sessile to sessile; sepals 5-6, united at base, ovate, unequal, in two rows, 3 inner larger, c. 3-5 × 1 mm, 3 outer smaller, c. 1.5-2 × 0.7 mm, persistent in fruit; petals 5,

free, oblong-lanceolate, white; staminodes and disc absent; ovary superior, trilocular with 1 ovule per locule, green, glandular hairs present; style short; stigma bifurcate, white, greenish at base, stigmatic papillae absent. **Fruits** trilocular capsule, deltoid at shape, 3-5 mm diameter; subsessile; persistent sepals 5-6, ovate to deltoid, c. 5 × 3 mm. **Seeds** globose, brown, diameter c. 2 mm, with narrow transverse scale-like processes, ecarunculate (Figure 1).

Distribution: Mexico and West Indies to Argentina. The species was also distributed to Africa and Madagascar (Brown et al., 1913; Macbride, 1951). It is here reported from Bogor (West Java) and Rembang (Central Java).

Specimens examined: **Indonesia. West Java:** the roadside from Duta Berlian Hotel to Babakan Lio, near ricefield area, Dramaga Sub-district, Bogor Regency, ± 201 m alt, 6° 33'22.20"S 106° 43'47.30"E, 16 July 2019, *MR Hariri 47* (FIPIA); Rice Field Observation of Agronomy & Horticultural Department, Agricultural Faculty, IPB University, Dramaga, Bogor Regency, 6° 33'47.9"S 106° 44'10.0"E, 04 December 2019, Z Al Anshori, *DRG12119-001* (FIPIA). **Central Java:** ricefield, Kedungdowo, Sidorejo Village, Sedan Sub-district, Rembang Regency, 6° 45'54.8"S 111° 34'34.3"E, August 2019, Z Al Anshori, *RBG0819-001* (FIPIA). **Puerto Rico,** Arecibo, 3/5/1847, *Krebs s.n.* (BO). Other specimens from Java were not found at BO.

Habitat and ecology: The species can be found in roadside, ditches, swamps, and other wet habitats (Webster & Burch, 1967).

Note: *Caperonia* A.St.-Hil. is a genus new for Malesia and it has been found in Java, Indonesia. The genus consists of monoecious herb or shrub having indumentum in the form of simple hairs, non-pulvinate petiole, the absence of both marginal glands on leaf teeth and adaxial basal glands, flowers with free petals, the absence of disc on the staminate flowers, psitillate flowers with non-papillate stigma, muricate ovary, and seed without caruncle (van Welzen, 1999). The specimens from Java were identified as *Caperonia palustris*, due to its glandular hairs on the stem and petiole, triangular to lanceolate or subulate stipules, and leaves in ovate-oblong, elliptic-oblong to lanceolate shape. The species may have been accidentally introduced to Java as soil contaminants. But, the time and vector of introduction are uncertain. The species has been described as an invasive alien species in the southern United States since 2007 (Miller et al., 2010; Godara et al., 2011). Thus, its occurrence in Java needs to be noticed. In Bogor and Rembang, the species grows as a weed along ricefields and according to our observation, the seeds are dispersed by water. The previous study showed that the seeds have a capability to survive under flooded conditions (Koger et al., 2004).

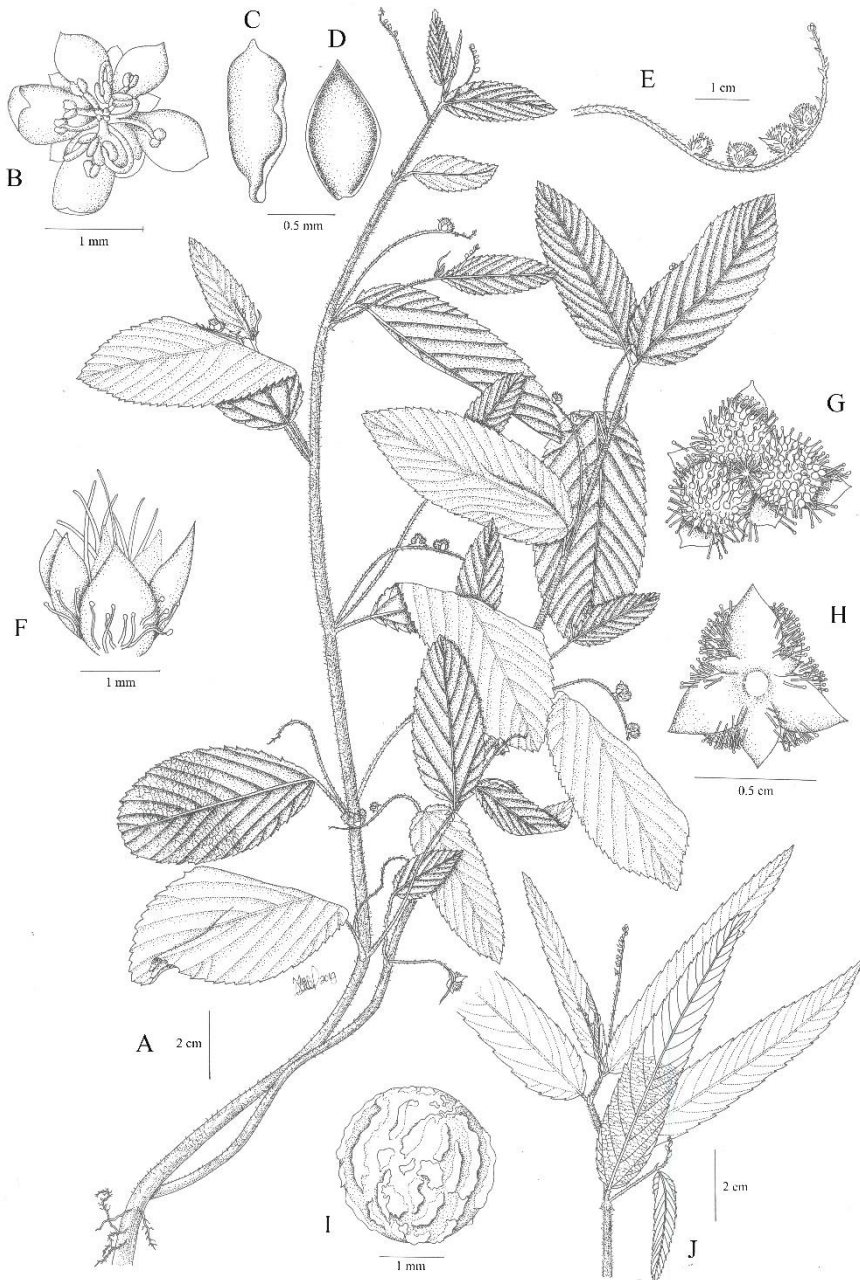


Figure 1. *Caperonia palustris* (L.) A.St.-Hil. a) habit; b) staminate flower; c) petal; d) sepal; e) infructescence, f) pistillate flower; g) adaxial surface of fruit, h) abaxial surface of fruit, i) ecarunculate seed, j) the leafy twig with linear-lanceolate leaves (Drawn by Z.A. Anshori)

The additional species of *Croton* from Java

A key to the genus *Croton* in Java, modified from Backer & Bakhuizen van den Brink (1963) and Esser (2005)

- 1 A. Herbs to sub-shrubs 2
- B. Shrubs or treelet, climber, with distinctly woody stem 3
- 2 A. Indumentum hispid, irritating hairs present, basal leaf glands stalked, leaf margin with coarse double-serration, fruit globose *C. hirtus*
- B. Indumentum flat, irritating hairs absent, basal leaf glands sessile, leaf margin with simple serration, fruit ellipsoid *C. bonplandianus*
- 3 A. Adult leaves on the lower surface are densely covered by scales, no epidermis visible, filaments hairy *C. argyratus*
- B. Adult leaves on the lower surface are covered by lepidote or stellate hairs, epidermis visible, filaments glabrous 4
- 4 A. Leaves entirely pinnately nerved, lateral nerves 7-11, stalked glands along the margins absent 5
- B. Leaves 5-7-nerved at base, lateral nerves 3-5, stalked glands along the margins present 6
- 5 A. Calyx-lobes in the pistillate flowers with a hair-tuft at the apex, outside nearly glabrous, fruits rather densely lepidote outside *C. oblongus*
- B. Calyx-lobes in the pistillate flowers thinly scaly, fruits sparsely lepidote outside *C. glabrescens*
- 6 A. Shrubs to treelet, leaf base broadly rounded or slightly deccurent, axis of inflorescence glabrous *C. tiglium*
- B. Climber, leaf base cordate, not deccurent, stellate-hairy above, axis of inflorescence densely pubescent *C. caudatus*

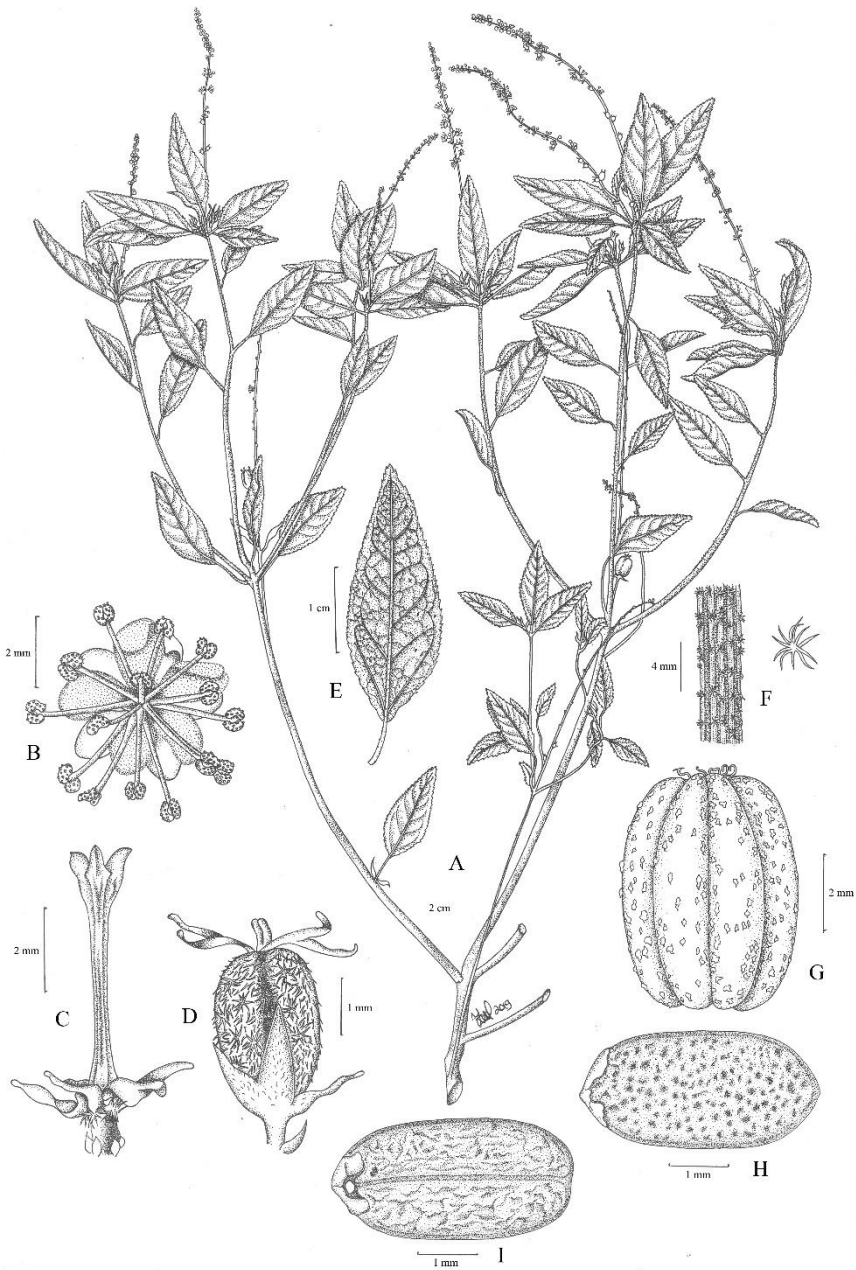


Figure 2. *Croton bonplandianus* Baill. A) habit; B) staminate flowers; C) pistillate flower; D) young fruit; E) adaxial leaf surface; F) young twig with stellate hairs; G) mature fruit, H) adaxial surface of seed, I) abaxial surface of seed. (All from PJBIND0419-001 (FIPIA). (Drawn by Z.A. Anshori).

Croton bonplandianus Baill., Adansonia 4: 339. 1864, Whitmore, Tree Fl. Malaya 2: 84. 1973; Keng, Conc. Fl. Sing. 109. 1990; Turner, Gard. Bull. Sing. 45(1): 82. 1993; Esser in Chayam. & Welzen, Fl. Thai. 8(1): 195, plate X: 3. 2005; De Egea, Peña-Chocarro, Espada & Knapp, PhytoKeys 9: 80. 2012; *Oxydectes bonplandiana* (Baill.) Kuntze, Revis. Gen. Pl. 2: 610. 1891. – Type: Argentina: Province de Corrientes: ca. 600 m, 1833, *Bonpland s.n.* (syntype P!-image seen [P00623060, P00623061, P00623062, P00623063]).

Croton pauperulus Müll.Arg., Flora 47: 485. 1864. – Synonym: *Oxydectes pauperula* (Müll.Arg.) Kuntze, Revis. Gen. Pl. 2: 612. 1891. – Type: *Tweedie 1215* (holotype K).

Croton sparsiflorus Morong, Ann. New York Acad. Sci. 7: 221. 1893. – Synonym: *Oxydectes sparsiflora* (Morong) Kuntze, Revis. Gen. Pl. 3(3): 289. 1898. – Type: Paraguay, Distrito Capital, Asunción, 1888/11/01, *Morong 43* (syntype NY!-image seen [NY00262959], BM!-image seen [BM000504228]; isosyntype NY!-image seen [NY00262957], GH!-image seen [GH00047430], US!-image seen [US00109758]).

Croton rivinoides Chodat, Bull. Herb. Boissier, sér. 2, 1: 395 1901. – Type: In campo prope Cerrito, Paraguay, 1885, *Hassler 1004* (isotype P!-image seen [P00623064, P00623065], NY!-image seen [NY00262944]).

Sub-shrub up to 50 cm high, monoecious, with clear sap, branching near base; indumentum consisting of stellate, whitish hairs, not irritating. **Leaves** simple, sub-opposite to spiral; petiole filiform, 0.5-1.5 cm long, reddish green; lamina ovate-lanceolate to rhomboid, 2.5-4 × 1-1.5 cm, base cuneate, margin serrulate, apex acute to acuminate or obtuse, adaxial surface shiny green, abaxial surface pale green, with sparse whitish stellate hairs, trinerved at base; basal glands 2 at junction petiole and lamina, oblong, c. 1 mm, brown, basal leaf glands sessile. **Stipules** subulate, c. 1 mm, whitish. **Inflorescence** unbranched thyrse, 9-9.5 cm long, flowers unisexual, peduncle 0.5 cm long; bracteoles subulate, ± 0.5 mm long. **Staminate flowers:** c. 4 mm wide; pedicels c. 2 mm long; sepals 5, united at base, ovate, 0.5-1 mm long, greenish; petals 5, free, curved, oblong, c. 2 mm long, white; disc present, lobed; stamens inflexed in bud, free, 15-16, filaments filiform, c. 1.5 mm long, white; anthers reniform, yellowish-white. **Pistillate flowers:** c. 2.5 mm wide; subsessile; sepals 5, united at base, triangular-ovate, c. 1.5 mm long, green; petals absent; ovary superior, trilocular with 1 ovule per locule, ovoid, c. 1 × 1 mm, green, whitish stellate hairs present; stigmas bifid, c. 1.5 mm wide, spreading, glabrous, creamy, persistent. **Fruits** capsules, ellipsoid, trigonous, c. 5 × 4 mm, green with purple-reddish tinged. **Seeds** ellipsoid, c. 5 × 3 mm, creamy white, carunculate (Figure 2).

Distribution: Southern Bolivia, Paraguay, South Western Brazil, and Northern Argentina (Radcliffe-Smith, 1986). The species was also occurred in Thailand and

Malesia (Malay Peninsula, Singapore, Borneo and Sulawesi). Recently, the species has been collected from Bekasi and Indramayu, West Java.

Specimen examined: **Indonesia. West Java:** Sumuradem, Sukra Sub-district, Indramayu Regency, 6°16'28.9"S 107°57'57.7"E, 24 April 2019, Zakaria Al Anshori *PJBINDO419-001* (FIPIA); PT PJB UP Muara Tawar, Segarajaya, Tarumajaya Sub-district, Bekasi, 6°05'20.3"S 106°59'58.3"E, 29 September 2019, Zakaria Al Anshori *MTW0919-001* (FIPIA). Other specimens were not found in BO.

Habitat and ecology: In Java, the species grows in open disturbed areas, roadsides, and abandoned lands. It can also be found near upper tidal areas and dry fishponds and associated with salt-resistant species like *Sesuvium portulacastrum* (L.) L. (Aizoaceae). *Croton bonplandianus* grows as weeds in Bekasi and Indramayu.

Note: In Java, the specimens were identified as *Croton bonplandianus*. The species was characterized by stellate hairs on its stem which are visible as white dots, leaves are 1-1.5 cm wide with dense simple serration, and sessile basal leaf glands. Similar to the previous species, *C. bonplandianus* might be introduced to Java as a soil contaminants. The information about when it was firstly introduced is unknown. Within Malesia and SE Asia, *C. bonplandianus* was recorded for Thailand, the Malay Peninsula, Singapore (Turner, 1993; Chong et al., 2009), Borneo and Sulawesi (Esser, 2005). Furthermore, the species has been considered as an invasive alien species in India and Bangladesh (Islam et al., 2003; Rao & Sagar, 2012).

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