



Musaceae of Andaman and Nicobar Islands with two new synonyms and one distributional record

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Abstract

Two recently published species of *Musa*, viz., *M. indandamanensis* and *M. paramjitiana*, are synonymized under *M. sabuana* and *M. balbisiana* var. *andamanica*, respectively based on critical study of types and specimens deposited in ASSAM, CAL, CALI, MH and PBL and careful observation of live plants in their natural habitats during the intensive field explorations in the Andaman and Nicobar Islands and Northeast India. Taxonomic note, colour photographs, ecology and conservation status are provided. Note on the disjunct distribution of *M. balbisiana* var. *andamanica* in Northeast India and Andaman and Nicobar Islands is also provided. In addition, *M. balbisiana* var. *andamanica* is lectotypified and *M. kattuvazhana* reported as an addition to the flora of Andaman and Nicobar Islands.

Keywords: Andaman and Nicobar Islands, *Musa balbisiana* var. *andamanica*, *Musa indandamanensis*, *Musa kattuvazhana*, *Musa paramjitiana*, New record, Synonym, Taxonomy

Introduction

Musa L. (Musaceae) is considered as one of the taxonomically challenging genera in the order Zingiberales because of similarities in habit, large size and the difficulty of identifying taxa from herbarium specimens in addition to collections of specimens from dense evergreen forest during monsoon season and processing of bulky specimens. The genus is mainly distributed in tropical Asia from Himalayas to northern Australia (Cheesman, 1947; Simmonds, 1962; Kress, 1990). In India, a total of 41 taxa are distributed in north-eastern states, Western Ghats, Eastern Ghats and Andaman and Nicobar Islands. At present, the north-eastern states are considered as the centre of diversity of the genus with 38 taxa (Joe, 2015).

The identity of recently described taxa from Andaman and Nicobar Islands has been an enigma to the authors for two years. However, extensive explorations have been conducted in the Andaman and Nicobar Islands during August 2017, during which intensive efforts have been made to collect all the taxa from their type localities and other species rich areas such as Baratang, Diglipur, Mayabunder, Little Andaman and Great Nicobar. The populations of *M. balbisiana* var. *andamanica*

and *M. paramjitiana* were found growing along with other *Musa* cultivars in the margins of secondary forests. The former is also widely cultivated by Bengali settlers and they called it as “Beejakela” (seeded banana) and the fruits are sold in markets, in spite of them being seeded, Bengali settlers never consider this as “Junglikela” (forest-seeded banana) and they use them for making various edible items and also consume the ripe fruits. It was reported that the early settlers had brought *M. balbisiana* var. *andamanica* from main land during early 1950's. The seeds of this variety might have been dispersed from cultivated fields to the forest margins by birds or other animals. Apart from the type localities, collections were made from all the major islands. Detailed field and laboratory studies have revealed that only one variety of *M. balbisiana* exists in all islands. The range of variation in different populations has also been studied critically and compared with *M. balbisiana* var. *andamanica* from Tripura (Joe, 2015). Singh (2014) while describing *M. paramjitiana* did not study the range of variation among the populations from different islands. The characters used for distinguishing *M. paramjitiana*, from *M. balbisiana* var. *andamanica* were, winged petiole bases, petiole margins curved inwards and closed, overlapping and clasping the pseudostem; lamina with cuspidate apex and obliquely

subcordate base and green dimorphic bracts of male and female buds. These characters are also seen in populations of *M. balbisiana* var. *andamanica*. Therefore, *M. paramjitiana* is treated here as conspecific with *M. balbisiana* var. *andamanica*.

During the present study some specimens of wild *Musa* collected from the North Andaman Islands have been identified as *M. kattuvazhana*, which is also reported here as a new record to the Flora of Andaman and Nicobar Islands. An identification key to the species of *Musa* in Andaman and Nicobar is provided along with taxonomic notes and colour photographs.

Key to the *Musa* Taxa in Andaman and Nicobar Islands

1. Male buds convolute, lanceolate; peduncles glabrous 2
1. Male buds highly imbricate, linear-lanceolate; peduncles pubescent **M. kattuvazhana**
2. Lamina auricled at base with one auricle pointed and other rounded; fruit apex bottle-necked up to 1 cm long with floral relicts; pulp yellow or orange..... **M. sabuana**
2. Lamina auricled at base with both auricles rounded; fruit apex blunt, without floral relicts; pulp creamy **M. balbisiana** var. **andamanica**

Taxonomy

Musa balbisiana var. *andamanica* D.B. Singh, Sreek., T.V.R.S. Sharma & A.K. Bandyop., Malayan Nat. J. 52: 157. 1998; Häkkinen & Väre, Adansonia 30: 68. 2008. **Lectotype (designated here):** D.B. Singh *et al.*, Malayan Nat. J. 52: 159, photographs 2,3. 1998. **Fig. 1**

Musa paramjitiana L.J. Singh, Nordic J. Bot. 35: 77. 2017, **syn. nov.** Type: INDIA, **Andaman and Nicobar Islands**, North Andaman, Diglipur, Krishnapuri, ± 32 m, 8.2.2013, L.J. Singh 29530 (Holo, CAL!; Iso, PBL, image!).

Flowering & fruiting: Throughout the year.

Habitat: This species grows in secondary forest margins throughout the Andaman Islands (Diglipur and Rangat of Middle Andaman, Badmash Pahar forest of Chouldari, South Andaman and along the way from Hut Bay to Vivekananthapur of Little Andaman). It is also cultivated locally for consumption. Earlier, it was also recorded from secondary forest margins of Tripura (Joe *et al.*, 2015).

Distribution: Andaman and Nicobar Islands and Tripura. **Endemic.**

Conservation Status: Numerous individuals were observed within Andaman Islands and Tripura. Following IUCN guidelines, presently its status can be assigned as Least Concern (LC). Collections made from different locations of Andaman Islands are introduced and maintained in Calicut University Botanical Garden (CUBG) Musaceae germplasm for future studies.

Specimens examined: INDIA, **Andaman and Nicobar Islands:** Middle Andaman, Kausalya Nagar, 3.8.2017, M. Sabu & V.S. Hareesh 152717 (CALI); North Andaman, near Shiv Mandir, 18 km from Mayabunder towards Diglipur, 4.8.2017, M. Sabu & V.S. Hareesh 152728 (CALI); Diglipur, Krishnapuri, 4.8.2017, M. Sabu & V.S. Hareesh 152738 (CALI); Lakshmipur, 4.8.2017, M. Sabu & V.S. Hareesh 152743 (CALI); near Kali Mandir, 7.8.2017, M. Sabu & V.S. Hareesh 152769 (CALI); Little Andaman, Ramakrishnapur, 9.8.2017, M. Sabu & V.S. Hareesh 152778 (CALI). **Tripura,** South Tripura, Durgapur, left from Garjee, 23°22.614' N, 91°36.266' E, 91 m, 22.5.2011, A. Joe & Sreejith 116152 (CALI).

Note: While describing *M. balbisiana* var. *andamanica*, Singh *et al.* (1998) reported that the type specimens are at CAL and PBL, but we could not locate the specimens in either herbarium. Therefore, the photographs 2 and 3 given by the authors. in the protologue are designated here as the lectotype.

Musa kattuvazhana K.C. Jacob, Madras Bananas Monogr.: 129. 1952; Karthik. *et al.*, Fl. Ind. Enum. Monocot. 4: 104. 1989; Häkkinen & Väre, Adansonia 30: 81. 2008; Häkkinen, Taxon 62: 810. 2013. Type: Fig. 73 'Kattu Vazha', in K.C. Jacob, Madras Banana Monogr. 1952 (Epitype designated by Joe *et al.*, Webbia 71: 204. 2016). **Fig. 2**

Musa banksii F. Muell. var. *singampatti* T.G. Nayar, Indian J. Hort. 9: 14. 1952 (cf. Häkkinen & Väre, 2008). Type: T.G. Nayar, Indian J. Hort. 9: f. 1. 1952. (Lectotype designated by Häkkinen & Väre, 2008).

Musa acuminata subsp. *burmannica* N.W. Simmonds, Kew Bull. 11: 468. 1957. (cf. Häkkinen & Väre, 2008).

Musa acuminata auct. non Colla 1820: N. Mohanan & Sivad., Fl. Agasthyamala: 713. 2002; Sasidh., Biodivers. Doc. Kerala Pt. 6: Fl. Pl.: 486. 2004.

Musa rosacea auct. non Jacq. 1804: Manilal, Fl. Silent Valley: 316. 1988; Sivar. & P. Mathew, Fl. Nilambur: 718. 1996.

Flowering & fruiting: Throughout the year.

Habitat: Evergreen forest.

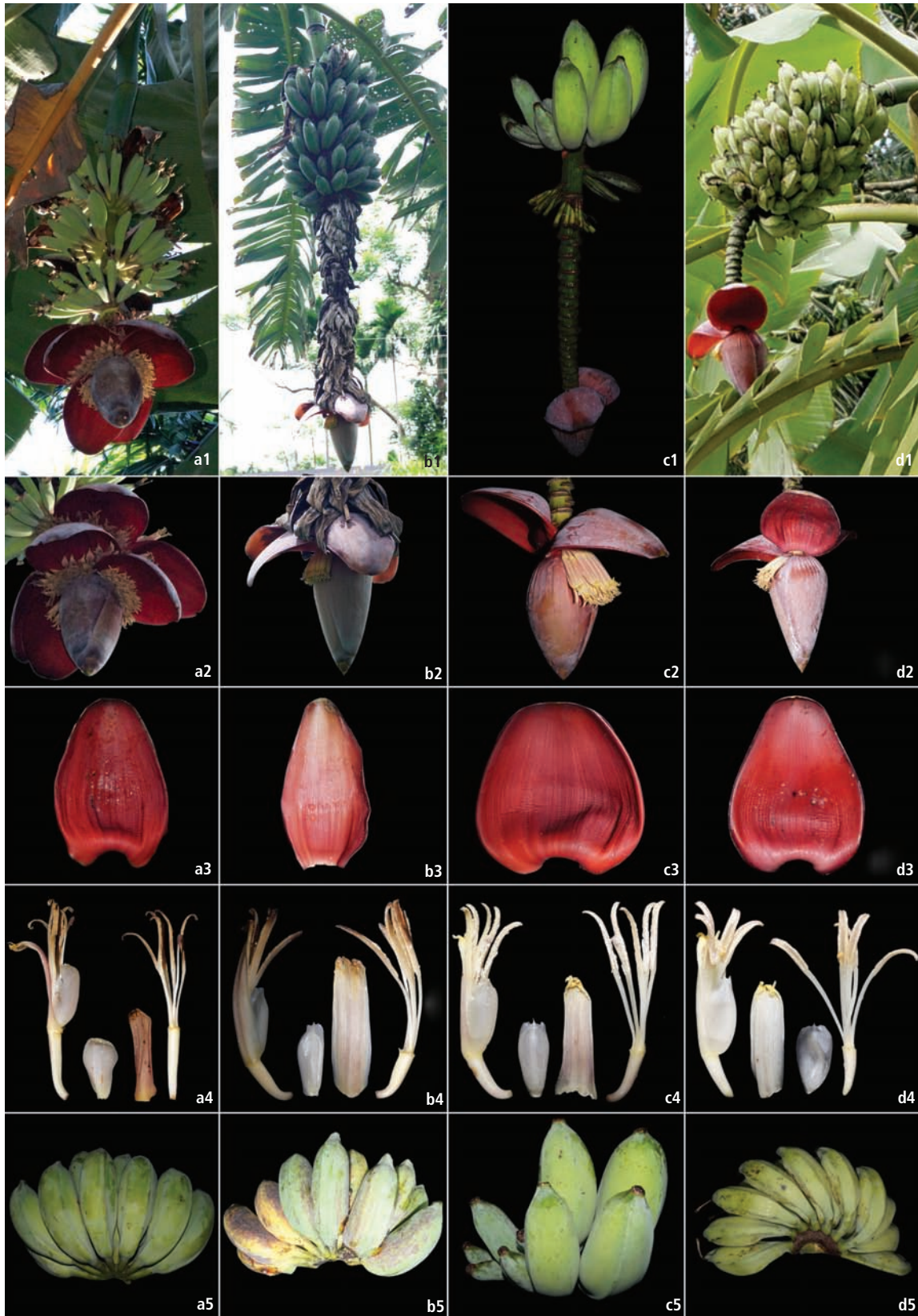


Fig. 1. *Musa balbisiana* var. *andamanica* D.B. Singh, Sreek., T.V.R.S. Sharma & A.K. Bandyop.: a1–a5. Ramakrishnapur; b1–b5. Krishnapur; c1–c5. 18 km from Mayabunder towards Diglipur; c1–c5. Tripura; a1, b1, c1, d1. Inflorescence; a2, b2, c2, d2. Male bud; a3, b3, c3, d3. Male bract; a4, b4, c4, d4. Male flower and parts; a5, b5, c5, d5. Fruit bunch. (Photos by M. Sabu & V.S. Hareesh).



Fig. 2. *Musa kattuvazhana* K.C. Jacob: a. inflorescence; b–l. Female flower parts: b. Flower bunch; c. Bract; d. C.S. of ovary; e. Single flower; f. Flower without tepals; g. Free tepal; h, i. Compound tepal; j–p. Male flower and floral parts: j. Male Bud; k. Apex of bud enlarged; l. Bract; m. Single flower; n. Rudiment pistillode with stamens; o. Compound tepal; p. Free tepal.

Distribution: India (Andaman and Nicobar Islands, Karnataka, Kerala and Tamil Nadu), Myanmar and Thailand.

Specimens examined: INDIA, **Andaman and Nicobar Islands:** North Andaman, East Island Wildlife Sanctuary, 25.12.2011, *M.Y. Kamble* 29354 (PBL); Diglipur, 4.8.2017, *M. Sabu & V.S. Hareesh* 152739 (CALI); Diglipur, Saddle Peak foothill, 6.8.2017, *M. Sabu & V.S. Hareesh* 152760 (CALI). **Kerala,** Idukki district, on the way to Munnar from Adimali, near Velara water falls, 5.4.2016, *A. Joe* 148737 (CALI); Vaguvarai, 9.4.2016, *V.S. Hareesh* 143936 (CALI); Palakkad district, Silent Valley R.F., Anavai, 1100 m, 28.4.1977, *E. Vajravelu* 49811 (MH); 21.2.1979, *E. Vajravelu* 58037 (MH); E.B. Rest House area, 1000 m, 8.10.1979, *N.C. Nair* 64401 (MH); Dam site area, 950 m, 20.12.1980, *N.C. Nair* 69688 (MH); Koomenkundu, 17.9.1982, *Sathish Kumar* 10756 (CALI); Thiruvananthapuram district, Agasthyamala, Athirumala, 1200 m, 15.10.1988, *N. Mohanan* 4445 (CALI); Thrissur district, way to Malakkapara, 788 m, 10.7.2012, *A. Joe & P.E. Sreejith* 130883 (CALI); 820 m, 10.7.2012, *A. Joe & P.E. Sreejith* 130885 (CALI); 795 m, 10.7.2012, *A. Joe & P.E. Sreejith* 130887 (CALI).

Note: While studying the holdings of *Musa* at PBL, a specimen collected by *M.Y. Kamble* (*M.Y. Kamble* 29354) from East Island Wildlife Sanctuary, North Andaman Islands was noted determined as *M. acuminata* and also supplemented with illustration and brief description of the plant in a separate sheet, however on critical scrutiny it is identified as *M. kattuvazhana*. Interestingly, this species was collected from North Andaman also during a recent tour. *Musa kattuvazhana*, is hitherto known only from the Western Ghats (*Joe et al.*, 2016), and the present records of its occurrence in the Andaman and Nicobar Islands exhibit an extended distribution of this species, and the first record of this species for the Islands. Isolated populations of this species in the Jirkatang areas of South Andaman, Keralapuram and Diglipur of North Andaman, along the foothills of Saddle Peak National Park with more than 20 clumps were observed by the present authors along the streams in association with *Amomum aculeatum* Roxb., *Calamus* sp., *Dipterocarpus* sp., *Hopea* sp. and *Ophiorrhiza trichocarpon* Blume. The major difference observed in the Andaman populations is the 30 cm long, linear-lanceolate male buds otherwise all other characters clearly match those of *M. kattuvazhana*.

Musa sabuana K. Prasad, A. Joe, Bheem. & B.R.P. Rao, Indian J. Forest. 36: 151. 2013. Type: INDIA,

Andaman Islands, Middle Andamans, near Panchavati, 14.6.2012, *Prasad & Bheemalingappa* 44147 (Holo, CALI; Iso, SKU!, CALI!). **Fig. 3**

Musa indandamanensis L.J. Singh, Taiwania 59: 27. 2014, **syn. nov.** Type: INDIA, **Andaman and Nicobar Islands,** Little Andaman, Hut Bay, Krishna Nalah, ± 23 m, 4.4.2012, *L.J. Singh* 29530 (Holo, CALI; Iso, PBL, image!).

Flowering & fruiting: Throughout the year.

Habitat: Evergreen forest. In Andaman Islands, the plants are mostly growing in association with *Phrynium* sp., *Artocarpus gomezianus* Wall. ex Trécul and *Dipterocarpus costatus* C.F. Gaertn. The plant height varies considerably depending on the habitat. The plants growing in shady areas are taller compared to those in open areas. It grows in association with *Etlingera fenzi* (Kurz) Škorničk. & *M. Sabu*, *Osbeckia* sp. and *Spathoglottis plicata* Blume.

Distribution: India (Andaman and Nicobar Islands). **Endemic.**

Conservation status: Prasad *et al.* (2013) have assessed *M. sabuana* as a Critically Endangered species. During our recent field work, we have recorded a few more individuals in Middle Andaman and several populations in Little Andaman and Great Nicobar Island. In little Andaman, elephants feeding the whole plant as well as fruits and civets eating the ripe fruits of this species were observed by the authors. The ongoing anthropogenic activities such as road broadening and deforestation may lead to decrease in number of population of this species in Great Nicobar. Local people informed that many populations disappeared during a tsunami in Great Nicobar Island on 26 December 2004. Based on known populations, its threat status is tentatively assigned here as Vulnerable (VU) B2a,ci,ii,iii,iv+C2ai,ii (IUCN, 2017). As part of a conservation measure, some plants were introduced in Calicut University Botanical Garden, and conserved as Musaceae germplasm, for future studies.

Specimens examined: INDIA, **Andaman and Nicobar Islands:** Middle Andaman, near Panchavati, 14.6.2012, *Prasad & Bheemalingappa* 44147 (CAL, CALI, SKU); Little Andaman Islands, near Ramakrishnapur, 21.6.2012, *Prasad & Bheemalingappa* 44149 (SKU); Hut Bay, Krishna Nalah, 4.4.2012, *L.J. Singh* 29530 (CAL, PBL); Jheenga Nalah, 5.4.2012, *L.J. Singh* 29532 (PBL); Ravindra Nagar, 18.11.2012, *L.J. Singh* 29568 (PBL); Sunderpur, 17.4.2013, *L.J. Singh* 29588 (PBL); Prabhash Mundi, 19.4.2013, *L.J. Singh* 29599 (PBL); Ramakrishnapur, 9.8.2017,



Fig. 3. *Musa sabuana* K. Prasad, A. Joe, Bheem. & B.R.P. Rao: a1–a8 (Little Andaman); b1–b8, c–k (Great Nicobar): a1, b1. Inflorescence; a2, b2. Fruit bunch; a3, b3, c,d. Intermediate forms of male bud; a4, b4. Male bract; f. Female inflorescence (early stage); g. Flower bunch; h–j. Female flower parts; h. Single flower; i. Compound tepal; j. Free tepal; k. Female bud; a5–a8, b5–b8. Male flower parts: a5, b5. Single flower; a6, b6. Rudiment pistillode with stamens; a7, b7. Free tepal; a8, b8. Compound tepal (Photos by M. Sabu and V.S. Hareesh).

M. Sabu & V.S. Hareesh 152776 (CALI); Krishna Nalah, 9.8.2017, *M. Sabu & V.S. Hareesh* 152779 (CALI); Great Nicobar Island, 33 km on East-West Road, 22.7.1976, *N.P. Balakrishnan* 3943 (PBL); 37.5 km North-South Road, 30.7.1981, *D.K. Hore* 8858 (PBL); Navy Dera, 21.2.2003, *J. Jayanthi* 19408 (PBL) (misidentified as *M. acuminata*); Campbell Bay, Vijayanagar, 17.8.2017, *V.S. Hareesh* 152785 (CALI); Laxmi Nagar, 17.8.2017, *V.S. Hareesh* 152786 (CALI); 1 km away from Laxmi Nagar towards Indira Point, 17.8.2017, *V.S. Hareesh* 152787 (CALI); 1 km away from Great Nicobar Biosphere Reserve check gate, 18.8.2017, *V.S. Hareesh* 152789 (CALI).

Note: *Musa sabuana* was first described in 2013 from the Andaman Islands with the distinguishing features of: spiral arrangement of leaves; fruits with bottle-necked apex and bracts brown-purple with green striations. But the authors did not describe the character of the ripe fruits and seeds. Subsequently, Singh (2014) published *M. indandamanensis* from Hut Bay of Little Andamans, which is very close to the locality from where the paratype of *M. sabuana* was collected.

During our recent exploration to Andaman and Nicobar Islands we have collected specimens from the type localities of both taxa, *M. sabuana* (Ramakrishnapur, Little Andaman) and *M. indandamanensis* (Krishna Nalah, Jheenaga Nalah, Sunderpur and Ravindra Nagar of Little Andaman). The characters of these were found to be similar with those of populations from the nearby areas. Specimens were also collected from Campbell Bay towards Indira Point and Great Nicobar Biosphere Reserve, which showed similar floral characteristics. All the collections made so far exhibit highly variable bract colour (**Fig. 3 a3, b3, c–e**). The colour of bracts range from green to purple with intermediate shading and purple with green stripes. Those populations also showed inflorescences with green and brown-purple bracts, with different gradations of brown-purple with a green tinge, green with a brown-purple tinge, brown-purple with green striations and green with brown-purple striations or patches.

The glaucous nature of the dorsal surface of leaves and shape of flower buds are also highly variable. The plants growing in shade are glabrous or only slightly glaucous, whereas those growing in open areas have glaucous leaves. The pulp colour of ripe fruits is orange in all collections, which was not recorded in the description of *M. sabuana*. Otherwise, all other floral characters fall within the range of *M. sabuana*, hence *M. indandamanensis* is treated here as a synonym of *M. sabuana*.

The collections of *M. sabuana* from Great Nicobar Island (Campbell Bay) support the extended distribution of the species from the Nicobar groups of Islands. Several populations were observed the way from Campbell Bay to Indira Point and East-West road.

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