Jpn. J. Histor. Bot. Vol. 19 Nos. 1–2 p. 1–14 April 2011 植生史研究

Minoru Tsukagoshi[1,*], Arata Momohara[2] and Mutsuhiko Minaki[3]: *Metasequoia* and the life and work of Dr. Shigeru Miki

Abstract Dr. Shigeru Miki (1901–1974) made great contributions to the fields of paleobotany, paleoecology, and plant taxonomy, including the discovery of *Metasequoia* Miki and the study of extant water plants. Details of Dr. Miki's biography, the original description of *Metasequoia*, his collection of fossil and extant plants that are stored in the Osaka Museum of Natural History, the introduction of living *Metasequoia* to Japan, episodes of Dr. Miki's life, and a list of Dr. Miki's publications are presented in this paper. Dr. Miki was a scientist and colleague who spent his career being enthused with research of the natural world.
Key words: bibliography, Dr. Shigeru Miki, *Metasequoia*

Introduction

Dr. Shigeru Miki (1901–1974; Fig. 1) established the genus *Metasequoia* Miki in his paper entitled "On the change of flora in eastern Asia since Tertiary period (I). The clay or lignite beds flora in Japan with special reference to the *Pinus trifolia* beds in central Hondo." This paper was published on September 18, 1941 in the *Japanese Journal of Botany*. Accordingly 2010 is the 70th anniversary of the establishment of the genus *Metasequoia,* and as a tribute to Dr. Miki the Third International *Metasequoia* Symposium was held at the Osaka Museum of Natural History.

In this paper we summarize the life and work of Dr. Miki, describe the history of living *Metasequoia* following its introduction to Japan in 1950, and provide a list of Dr. Miki's publications.

Biography of Dr. Shigeru Miki

Biographies of Dr. Miki have been published by Kokawa (1990), Saito (1995), and Tsukagoshi (2010). We summarize them in this paper and introduce aspects of his life with a photographic collage.

Dr. Miki was born in the town of Miki, Kida Province, Kagawa Prefecture in 1901. Following graduation at the Morioka Higher Professional School of Agriculture and Forestry (later Faculty of Agriculture, Iwate University), he became a teacher at the Ishikawa Prefectural School of Agriculture and Forestry. A short time later he left Ishikawa Prefectural School and en-

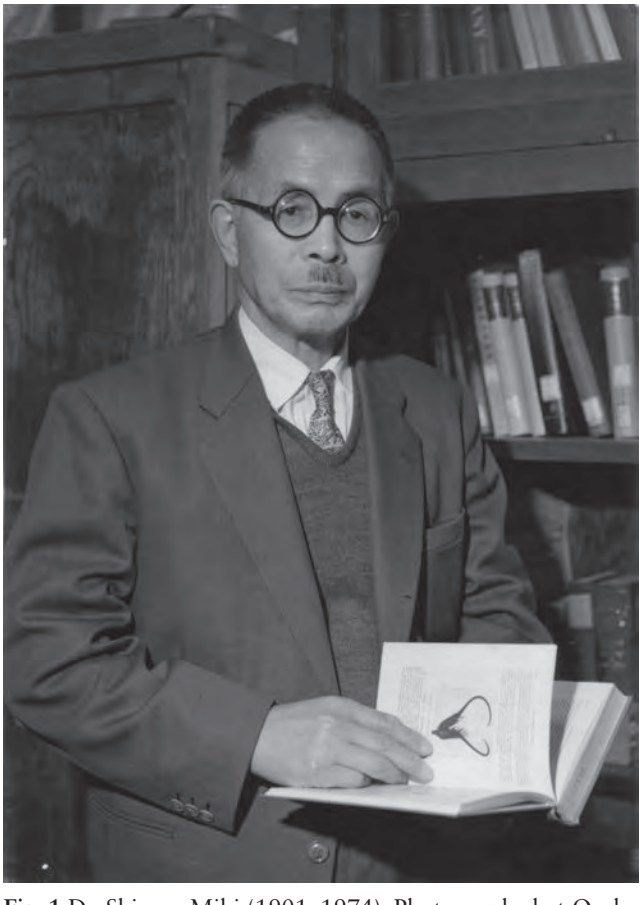

Fig. 1 Dr. Shigeru Miki (1901–1974). Photographed at Osaka City University in 1963.

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tered the Department of Botany, Faculty of Science, Kyoto University to study plant taxonomy. He began the study of the taxonomy and ecology of water plants under Professor Kwan Koriba (Figs. 2, 3). In 1925, he graduated from Kyoto University and became an assistant at Kyoto University. In 1931, he began working on fossil plants. His thesis was founded on better understanding changes in aquatic floras in time and in space. In 1949, he was promoted to Professor of the Faculty of Science and Technology, Osaka City University (Figs. 4, 5). After retiring from the Osaka City University, he was appointed Professor of the Faculty of Pharmacy Mukogawa Women's University.

From 1971 to 1974 he was the president of a support group for Osaka Museum of Natural History and here he focused on disseminating information about natural history to children and the community (Fig. 6).

Highlights of Dr. Miki's life

1901. Born in the town of Miki, Kida Province Kagawa Prefecture.
1918. Graduated from the Kida School of Agriculture and Forestry (later the Faculty of Agriculture Kagawa University).
1921. Graduated from the Morioka Higher Profes-

Fig. 3 A photograph showing Dr. Miki collecting specimens of *Nuphar* Sm.

Fig. 2 Dr. Miki as a student in the Department of Botany, Faculty of Science, Kyoto University.

Fig. 4 Dr. Miki in the laboratory of Osaka City University in 1957.

sional School of Agriculture and Forestry (later the Faculty of Agriculture, Iwate University). He became a teacher at the Ishikawa Prefectural School of Agriculture and Forestry.

1922. Entrance into the Department of Botany Faculty of Science, Kyoto University.
1925. Graduaed from Kyoto University and hired as an Assistant Professor at Kyoto University.
1937. Published "The water phanerogams in Japan, with special reference to those of Prov. Yamashiro".
1938. Completed his doctoral dissertation at Kyoto University "On the Pleistocene Flora in Prov. Yamashiro with the descriptions of 3 new species and 1 new variety".
1939. Promoted to Lecturer at Kyoto University.
1941. Established the new fossil genus *Metasequoia* in the paper "On the change of flora in eastern Asia since Tertiary Period (I). The clay or lignite beds flora in Japan with special reference to the *Pinus trifolia* beds in Central Hondo".
1944. Appointed as a researcher, Makassar Institute at Borneo.
1947. Promoted to Professor, Osaka University of Liberal Art and Education (later the Osaka University of Education).
1949. Promoted to Professor of the Faculty of Science and Technology, Osaka City University.
1951. Won the Asahi Shimbun Company prize for culture.
1964. Retired from the Osaka City University and appointed Professor of the Faculty of Pharmacy Mukogawa Women's University.
1974. Deceased (73 years old).

Fig. 5 Dr. Miki (left) at the laboratory, Osaka City University laboratory in 1964 with Dr. Shohei Kokawa (center) and Dr. Baki Kasapligil (right).

Fig. 6 Dr. Miki discussing *Convallaria* L. (lily of the valley) to elementary and junior high school students at an educational event organized by the Osaka Museum of Natural History.

Bibliography of Dr. Shigeru Miki

Dr. Miki published 120 papers and wrote and edited two books (Appendix 1). Dr. Miki had great achievements in late Cenozoic paleobotany and paleoecology and the taxonomy of aquatic plants. Dr. Miki described the floral change of the late Pliocene to middle Pleistocene in Japan (Miki, 1948), collected many plant fossils throughout Japan, studied the taxonomy and phylogeny of fossil plants, and published a number of monographs on fossil plants. Important monographs include the Taxodiaceae (Miki, 1949c, 1950c), Pinaceae (Miki, 1957a), *Trapa* L. (Miki, 1952b), Nymphaeaceae (Miki, 1960a), Juglandaceae (Miki, 1955d), Vitaceae (Miki, 1956b), Alangiaceae-Cornaceae-Nyssaceae (Miki, 1956c), aquatic plants (Miki, 1961), and Lauraceae (Miki, 1970a).

Dr. Miki described many new species of fossil plants. However, in some cases he did not specify their type specimens. Some new species were described without any figures and photographs, and some were invalidly published names without description (e.g., some fossil species named by Miki, 1963a). As such, future work on Dr. Miki's collection will require lectotypification of parts of his collection and publication of valid descriptions for some of the fossil species that he named.

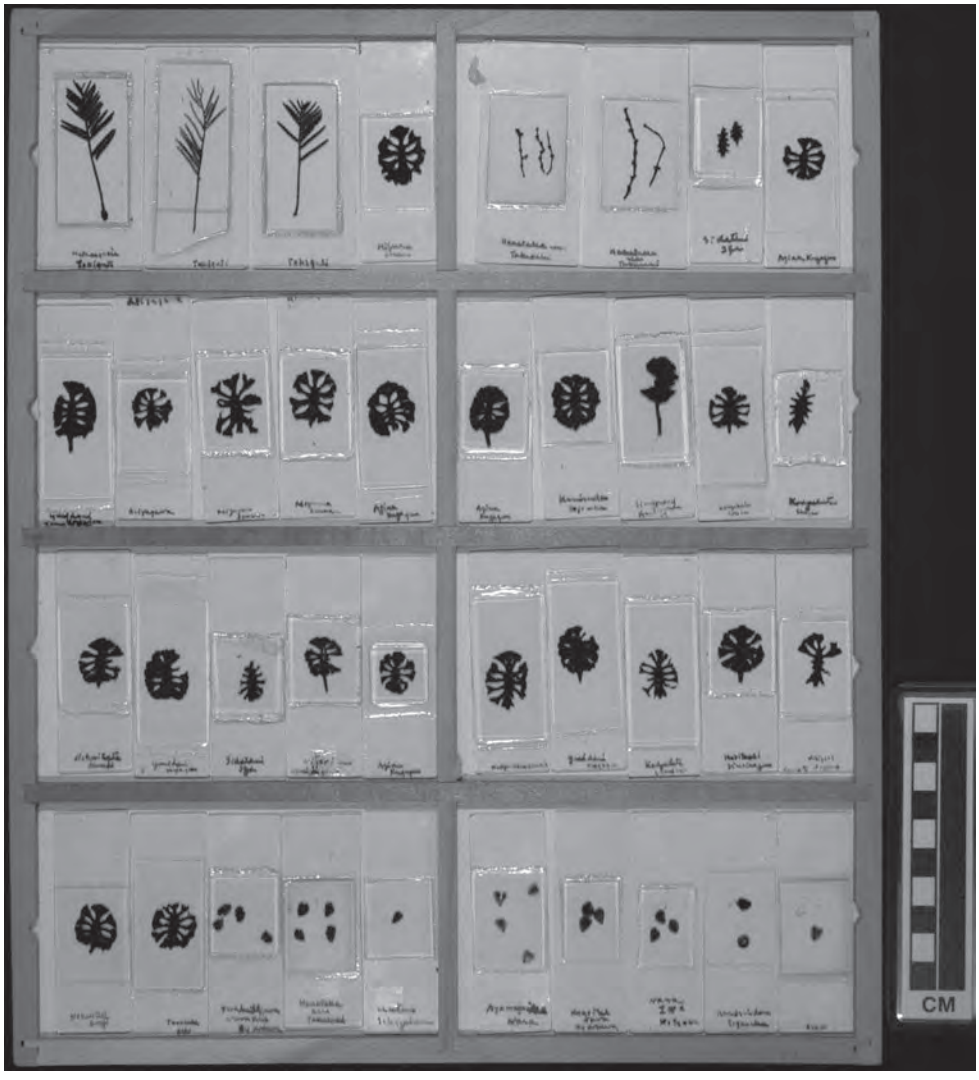


Fig. 7 Prepared specimens of shoot, cone (longitudinal section, axis), and seed remains of *Metasequoia disticha* (Heer) Miki. In the top row, the first and third shoots from the left (top left) are the specimens figured in Plate 5B (left) and Figure 8Da and in Plate 5B (centre) and Figure 8Db, respectively, of Miki (1941)(see Fig. 10). In the top row, the left shoot in the sixth slide from the left is the specimen illustrated in Figure 8Gc in Miki (1941). Graduations on the scale bar are 1 cm.

Dr. Miki's collections of Osaka Museum of Natural History

After his death in 1974, his collection was donated to the Osaka Museum of Natural History and the Mukogawa Women's University. Plant fossils and aquatic plant specimens reside in the Osaka Museum of Natural History, while extant plant specimens (excluding aquatic plants) are curated at the Mukogawa Women's University. The Osaka Museum of Natural History has published lists of these specimens (Nasu & Taruno, 1999; Kokawa et al., 2006; Shiga et al., 2009).

The specimens donated to the Osaka Museum of Natural History consist of plant fossil specimens that are stored in alcohol, prepared slide specimens, and extant plant materials that include herbarium sheets composed mainly of aquatic plants, prepared slides, and specimens preserved in alcohol. Catalogs of water plants (Shiga et al., 2009) and fossils of *Archaeozostera* Koriba et Miki (Nasu & Taruno, 1999) have been published.

The fossil and extant collection, excluding aquatic plants and *Archaeozostera*, was re-examined and arranged by Dr. Miki's favorite pupil, Dr. Shohei Kokawa, together with Minoru Tsukagoshi, Mutsuhiko Minaki, and Arata Momohara. The work included taxonomic verification of the specimens, label transcription and documentation, and replacement of the sample vials and preservative. Following Dr. Kokawa's death in 2001 Tsukagoshi, Minaki, and Momohara published a catalog listing the specimens held at the Osaka Museum of Natural History (Kokawa et al., 2006).

This catalog lists 24,779 plant fossil specimens and 7250 extant plants (Figs. 7–9). The fossil specimens includes 27 fungi, 5 algae, 164 bryophytes, 68 pteridophytes, 7214 gymnosperms, and 15,975 angiosperms with 25 galls, and 1326 unidentified plants. The extant specimens include 42 bryophytes, 118 pteridophytes, 662 gymnosperms, and 6289 angiosperms with 139 unidentified plants. The collection is composed mainly of various sizes of glass slides mounted with Canada balsam and vials of materials stored in 70% ethanol. The collection includes many of the type specimens and slides used by Dr. Miki to describe new species and materials of the extant plant specimens that illustrate aspects of plant morphology and anatomy that were used to facilitate the taxonomic identity of the fossil materials.

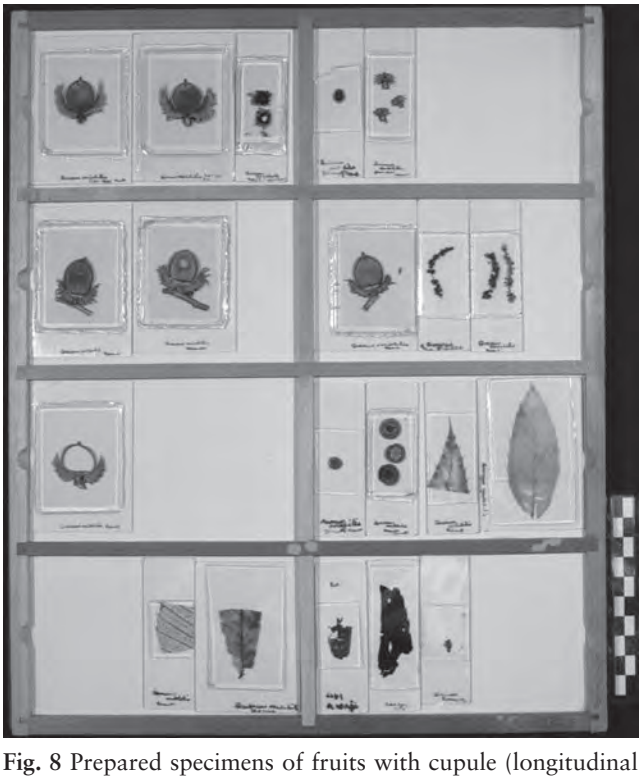


Fig. 8 Prepared specimens of fruits with cupule (longitudinal section), fruits (adhering part), cupules (juvenile), pericarps, male inflorescences, and leaves of extant plants (upper three rows and left half of the bottom row) and plant remains (right half of the bottom row) of *Quercus variabilis* Blume var. *brevipetiolata* Nakai. Graduations on the scale bar are 1 cm.

Fig. 9 Plant remains of *Pinus trifolia* Miki preserved in alcohol used in Plate 4E and Figure 3C of Miki (1939a). Graduations on the scale bar are 1 cm.

Original description of *Metasequoia*

Although Dr. Miki established *Metasequoia* in 1941 (Miki, 1941; Fig. 10), he had already described the character of shoots bearing distichous leaves and cones bearing decussate scales for a fossil taxon assigned to *Sequoia disticha* Heer (Miki, 1937; Figs. 1E–G, Pl. N–

***Metasequoia* n. g.** (Pl. V A–D, Fig. 8 A–H)

The remains have usually been referred to *Sequoia* or *Taxodium*, indeed the cone is like that of *Sequoia* and the foliage shoot is somewhat like those of *Taxodium*.

The cones were never found connected to branches, but as the leaf-scars on the peduncle are also distichous, it is conceivable that the cones and the shoots belonged to the same plant. The foliaged shoots seem to be lateral branches shedding in autumn, because their length is usually constant and the proximal end is covered by scaly leaves, although they have no scaly bud on the top and the branches two or more years old have two or more bud scars on the nearly same point as in Fig. 8 Ge.

The cone is distinguished from that of *Sequoia* by the decussate arrangement of scales and by the delicate peduncle having scale leaves at the base. The foliaged shoot differs from *Sequoia* by distichous arrangement of leaves and by the brittle petiole. At a glance the shape of the shoot of fragmental remain seems to be *Taxodium* or *Cephalotaxus* but it differs from *Taxodium*(1) by distichous leaf and parallel arrangement of stomata on it and from *Cephalotaxus* by short delicate shoot without scaly bud at the terminal and by the obtuse top of leaf.

The decussate arrangement of cone-scales is not found in living Taxodiaceae, but a common character in Cupressaceae. The shedding of lateral foliaged shoot with linear leaves is common in *Glyptostrobus* and *Taxodium*. So it is sure that the remains belong to Taxodiaceae but as the characters do not harmonize with those of the living forms, a new genus *Metasequoia* is established.

Character: Cone pedunculate, scale decussate, shield-form; peduncle with distichous scars of leaves and scaly leaves at the base. Shoot deciduous; leaf distichous, linear, obtuse, petiolate; stomata parallel to the midrib.

Two species were distinguished by the number of cone scales.

(1) The arrangement of stomata in *Taxodium* is transversal to the midrib (Fig. 8 I) being exceptional in Coniferae.

10. *Metasequoia disticha* n. g. n. com. (Pl. V A–Ca, Fig. 8 A–G)

Sequoia disticha HEER (1876) 63, pl. 12, fig. 2 a, pl. 13, fig. 9–11; NATHORST (1888) 5, pl. 1, fig. 1; MIKI (1937) 306, pl. 8 N-O, fig. 1 E-G.

Sequoia Onukii ENDO (1936) 173 fig. 6.

Taxodium distichum RICH. in FLORIN (1920) 16, 30, pl. 1, fig. 1–2; KONNO (1931) pl. 8, fig. 1–2.

Remains of cone and foliaged shoot were found from Osusawa. Cone elliptic, 15–20 mm long, 1.5–2 cm broad, pedunculate about 1–3 cm long. Scale 3–5 mm high, 11–14 mm broad, number of scale on the cone about 16–20; seed 4–5 mm long, 3–3.5 mm broad including the wings; twig with distichous pectinate leaves. Leaf linear, obtuse, 12 mm long, 1.5 mm broad, stomata parallel to the midrib on the ventral side.

The remains identified to the genus by decussate arrangement of cone scales and distichous arrangement of leaves and to the species by the size and shape of the leaf. This species was described by HEER as *Sequoia disticha*, but after his illustrations he did not note the scale leaves on the base of lateral branches. The difference is, however, not essential, because the destitution of scale leaves on the lateral branch of terminal shoot in *Taxodium* and *Sequoia* is quite usual.

Other localities in Japan: Cliff of Asiyagawa, Pref. Hyogo; Clay Beds of Huke and Tutimaru in Sennangun, Pref. Osaka; Clay Beds of Hasimoto, Pref. Wakayama; Clay Beds of Sidatani in Simagahara, Pref. Mie; Cliff of Syurakuen in Titagun, Pref. Aiti; Lignite Beds of Hanataka near Takasaki, Pref. Gunma.

11. *Metasequoia japonica* n. g. n. com. (Pl. V D, Fig. 8 Ab, H)

Sequoia japonica ENDO (1936) 172, fig. 5, 7–13; (1939) 337, pl. 23, fig. 15.

A few remains of cone occurred at Osusawa. The cone compressed, 1.2 cm long, 1.2 cm wide. Number of scale about 12–16, decussate; size of scale 10–11 mm broad, 4–5 mm high.

The remain identified to the genus by decussate arrangement of cone-scales and to the species by narrow and fewer number of cone-scales than the former.

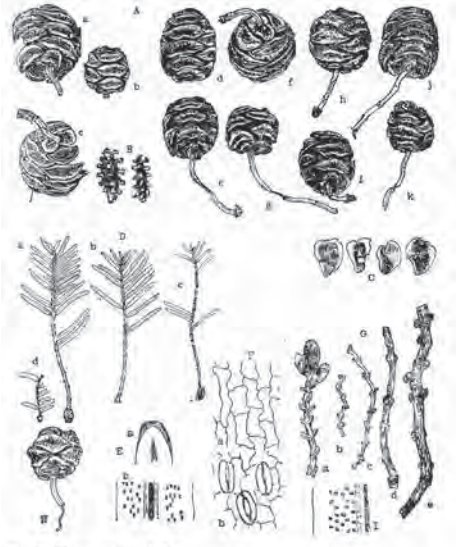
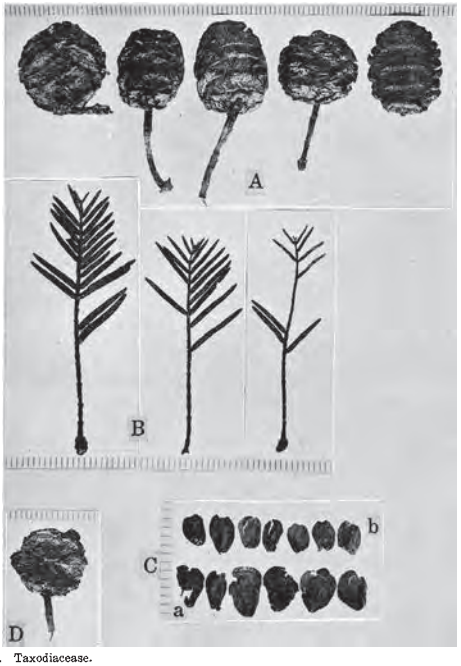


Fig. 8. *Metasequoia* excl. I.
A–G (excl. Ab) *Metasequoia disticha* n. g. n. com.
A Cones: *a* from Osusawa, *c* from Hanataka, Pref. Gunma, *d–k* from Hasimoto, Pref. Wakayama ×1.
B Axial parts of Cone ×1 from Sidatani, Pref. Mie.
C Seeds from Sidatani, Pref. Mie ×2.
D Foliaged shoots from Osusawa ×1.
E Leaf from Osusawa: *a* top ×10; *b* arrangement of stomata ×43.
F Epidermis of the leaf: *a* from upper side ×333; *b* stomata from underside ×333.
G Twigs: *a* young terminal shoot from Osusawa ×2; *b–e* two years old shoot from Hanataka, Pref. Gunma ×1; *d–e* shoot from Hasimoto, Pref. Wakayama ×1.
Ab, H *Metasequoia japonica* n.g. n. com. from Osusawa ×1.
I Arrangement of stomata on the living leaf of *Taxodium distichum* RICH. ×43.



Pl. V. Taxodiaceae.
A–Ca *Metasequoia disticha* n.g. n. com.
A Cones from Hasimoto, Pref. Wakayama. B Foliaged shoots from Osusawa. Ca Seeds from Hanataka, Pref. Gunma.
D *Metasequoia japonica* n.g. n. com. from Osusawa.
Cb, E–F *Sequoia sempervirens* ENDL. from Osusawa excl. Cb from Sidatani, Pref. Mie. E Cones. F Foliaged shoots.

Fig. 10 The original description of the fossil genus *Metasequoia* (Miki, 1941).

O). It is assumed that Miki had realized the oppositely-arranged leaves and the opposite and decussate seed cones were distinct and probably belonged to a new genus at the time of the 1937 publication, but held off describing a new genus until he had obtained more well preserved specimens. Miki (1937) also discussed the synonymy of the taxon with *Sequoia japonica* Endo and *Taxodium distichum* Richard and pointed out their wide distribution in the polar regions. *Sequoia disticha* was assigned to *Metasequoia disticha* (Heer) Miki and *Sequoia japonica* to *Metasequoia japonica* (Endo) Miki, respectively in Miki (1941).

Miki (1941)'s description of *Metasequoia* was based on various isolated parts of the plants including shoots, leaves, cuticles, seeds, and cones and was aimed to reconstruct the whole plant and its paleoecology. Among the four fossil localities that provided the fossil materials used for the description, the *Pinus trifolia* bed assigned to the early Pliocene by Miki (1941) is now correlated with the early late Miocene based on the fission track dating of 12–10 Ma from tephras in the Tokiguchi and Seto Porcelain Clay Formations (Todo Collaborative Research Group, 1999).

The establishment of *Metasequoia* and the discovery of living *Metasequoia* caused paleobotanists to re-examine fossil *Sequoia* and *Taxodium* that had been previously described (Chaney, 1950). Following re-examination of the fossil record, temporal and spatial distribution patterns of *Metasequoia* and their biogeography throughout the temperate regions of the Northern Hemisphere were clarified (Florin, 1963; LePage et al., 2005).

Introduction of living trees of *Metasequoia* into Japan

The *Metasequoia* Preservation Society was established on December 19, 1949. Initially, the Secretariat was set up by the Osaka University of the Liberal Art and Education, but was removed to the Osaka City University when Miki transferred institutions. Dr. Hitoshi Kihara, who was Dr. Koriba's senior pupil, became chairman of the *Metasequoia* Preservation Society (Fig. 11).

On February 28, 1950, one hundred seedlings of *Metasequoia glyptostroboides* Hu *et* Cheng were presented to the *Metasequoia* Preservation Society by Dr. Ralph W. Chaney, Berkeley University, USA. These seedlings were grown by Chaney from seeds planted in February 1949.

Many of these seedlings were planted throughout Japan to study their growth in various climate and soil types. The locations and number of seedlings planted throughout Japan are listed in Table 1 (*Metasequoia* Preservation Society, 1951a). In 1951, the tallest *Metasequoia* seedling was 125 cm in height and 2.3 cm in diameter and was growing at the Osaka City University (*Metasequoia* Preservation Society, 1951b). Records indicate that growth of the tree occurred very early in the growing season.

The first seed cones produced were from trees growing at the Yashiroda Botanical Garden, Shodo-shima Island, Kagawa Prefecture in 1952 (Yoshikawa, 1957). Although the tree growing at the Yashiroda Botanical Garden is not included in Table 1, it is assumed that this tree was initially sent to Osaka City University

Fig. 11 Dr. Ralph W. Chaney (left), Dr. Shigeru Miki (center), and Dr. Hitoshi Kihara (right). Dr. Kihara was a senior pupil in Dr. Koriba's laboratory and president of the *Metasequoia* Preservation Society. They took part in the planting of a small *Metasequoia* tree. The location and planting date are unknown.

Table 1 Distribution list of seedlings of *Metasequoia* sent by Dr. Ralph W. Chaney to the *Metasequoia* Preservation Society of Japan in 1950 (*Metasequoia* Preservation Society, 1951a).

Locations of *Metasequoia* seedlings planted in Japan in 1950	No.
Hokkaido (Sapporo City, Hokkaido Pref.)	3
Tohoku University (Sendai City, Miyagi Pref.)	3
The University of Tokyo	
University Forests of Amagi (Minami- Izu Town, Shizuoka Pref.)	4
University Forests of Chichibu (Chichibu City, Saitama Pref.)	4
University Forests of Kiyosumi (Kamogawa City, Chiba Pref.)	4
Faculty of Agriculture (Tokyo, Tokyo Pref.)	3
Koishikawa Botanical Gardens (Tokyo, Tokyo Pref.)	3
Nikko Botanical Garden (Nikko City, Tochigi Pref.)	3
Faculty of Science (Tokyo, Tokyo Pref.)	8
Tokyo Pref.	3
Shinjuku Imperial Garden (Tokyo, Tokyo Pref.)	2
The Government Forestry Experiment Station (Meguro, Tokyo, Tokyo Pref.)	4
Asakawa Forest, the Government Forestry Experiment Station (Hachioji City, Tokyo Pref.)	4
National Diet Building (Tokyo, Tokyo Pref.)	2
Kyoto University (Kyoto City, Kyoto Pref.)	12
Kyoto City (Kyoto Pref.)	3
Nara City (Nara Pref.)	2
Kobe City (Hyogo Pref.)	3
Nishinomiya City (Hyogo Pref.)	2
Osaka City (Osaka Pref.)	2
Osaka City University (Osaka City, Osaka Pref.)	3
Takarazuka Botanical Garden (Takarazuka City, Hyogo Pref.)	2
Nagoya City (Aichi Pref.)	3
Gifu City (Gifu Pref.)	3
Kochi University (Kochi City, Kochi Pref.)	3
Kyusyu University (Fukuoka City, Fukuoka Pref.)	3
Miyazaki niversity (Miyazaki City, Miyazaki Pref.)	2
Doshisya University (Kyoto City, Kyoto Pref.)	1
Tottori University (Tottori City, Tottori Pref.)	3
The Asahi Shinbun (Newspaper Company)	3
	100

or Kyoto University and was later transferred to the Yashiroda Botanical Garden. In 1953 seed cones were also confirmed at the Botanical Garden at the Faculty of Science, Kyoto University, and Kamigamo Experimental Forest Station, Faculty of Agriculture, Kyoto University. In 1972 a tree grown from cuttings of oritinal trees at the Kamigamo Experimental Forest Station bore the first pollen cones. However, it is believed that the cuttings were not cultivated from any of the original trees sent to the Kamigamo Experimental forest Station. In 1973 *Metasequoia* seeds collected from the trees growing at the Kamigamo Experimental Forest Station were germinated (Nakai & Furuno, 1974).

The purpose of the *Metasequoia* Preservation Society was to grow and increase the number of *Metasequoia* trees in Japan and to study the ancient environments under which *Metasequoia* grew. Besides these activities the *Metasequoia* Preservation Society provided reprints of Dr. Miki's (1950b) and distributed this paper to the community as an educational activity.

The *Metasequoia* Preservation Society propagated the species through cuttings and then sold them to schools, companies, and the public. These activities facilitated the distribution of the tree throughout Japan. Currently, large *Metasequoia* trees can be observed and enjoyed throughout the country because the trees grow very well in Japan. Thus trees introduced in 1950 cannot be distinguished from those propagated from cuttings of original trees. Unfortunately some trees introduced in 1950 were cut down unintentionally. We could confirm the *Metasequoia* trees that were introduced in 1950 at only six institutes as follows: Botanical Garden Faculty of Science Osaka City University;

Fig. 12 Dr. Miki's students and staff during a laboratory outing. Front row, left, Dr. Hideo Takada, center Dr. Jitsuro Ueno, right, Dr. Shigeru Miki. Middle row, Dr. Matsuo Tsukada.

Botanical Garden Faculty of Science Kyoto University; Kamigamo Experimental Forest Station, Faculty of Agriculture, Kyoto University; Kobe Municipal Arboretum; The Government Forestry Experiment Station (Meguro); Tohoku University. These trees should be preserved as a monument to the international collaboration of scientists and exchange of ideas since the introduction of *Metasequoia* to Japan.

The discovery of living *Metasequoia* that Dr. Miki had initially established on the basis fossil materials brought very good news for Japan following World War II. His contribution was honored with the 1950 Asahi Prize for distinguished researchers. *Metasequoia* and the word "living fossil" became popular throughout the world because of the discovery of the living plants and Dr. Miki's description of a living fossil. In Japan nursery trees were supplied to each school as an example of a "living fossil". This is one reason that *Metasequoia* is perhaps one of the best known trees in Japan.

Anecdotes of Dr. Shigeru Miki

Dr. Miki immersed himself in study and is remembered by a number of great achievements, including the discovery and description of fossil *Metasequoia*. The following anecdotes of Dr. Miki were provided by Mrs. Tamiko Miki, who was Dr. Miki's wife, and Dr. Shohei Kokawa, who was Dr. Miki's pupil (Figs. 12–15):

- There was a person in a pond who wore a suit. It was Dr. Miki who was collecting aquatic plants.
- When it rained heavily, Dr. Miki went to the fossil localities by train, only leaving a message to his wife, just saying going to the west or to the east. When he found a cliff from the train, he got off at the next station and collected plant fossils.
- After collecting plant fossils by Dr. Miki, there were no plant fossils left at the outcrop. Another paleobotanist had to wait for the next heavy rain to destruct

Fig. 13 Dr. Miki crouching on a boardwalk in the pond where *Trapa* and *Nuphar* had been growing.

Fig. 14 Shigeru Miki with his wife Tamiko Miki. She had visited the first discovered *Metasequoia* tree in China in 1988.

Fig. 15 Two trees of *Metasequoia* and one tree of *Sequoia* at the home of Dr. Miki in Takarazuka City, Hyogo Prefecture. The word Miki means three trees in Japanese.

the cliff.

- There was no fingerprints on Dr. Miki's fingers because he ground plant fossils on whetstones without gloves to make prepared slides.
- Dr. Miki instructed students to observe plants by using five senses, "Sight, sense of touch, olfaction, taste, and hearing."

Dr. Miki also served as a member of the editorial board for science textbooks published by Osaka Shyoseki Co. Ltd. Miki's work and discovery of *Metasequoia* were published in a school textbook of morality by Osaka Shyoseki Co. Ltd. Each school that adopted the textbook was provided with *Metasequoia* seedlings by Osaka Shyoseki Co. Ltd. (Saito, 1995; Sakazaki & Ando, 1998).

In looking back on his research (Miki, 1964c, d), Dr. Miki wrote, "My life was like that of a mole, because I studied aquatic plants and plant fossils, which were obtained from under the horizon or from underground," and "I could keep researching by the help of everybody. I make an effort to complete my incomplete research." Dr. Miki was a researcher who was enthusiastic with the study of nature.

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