New fossil seeds of Eurya (Theaceae) from East Asia and their paleobiogeographic implications

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A B S T R A C T

Eurya has an excellent fossil record in Europe, but it has only a few fossil occurrences in East Asia though this vast area houses the highest modern diversity of the genus. In this study, three-dimensionally preserved fossil seeds of Eurya stigmosa (Ludwig) Mai from the late Pliocene of northwestern Yunnan, southwestern China are described. The seeds are compressed and flattened, slightly campylotropous, and nearly circular to slightly angular in shape. The surface of the seeds is sculptured by a distinctive foveolate pattern, consisting of funnel-shaped and finely pitted cells. Each seed valve contains a reniform or horseshoe-shaped embryo cavity, a characteristic condyle structure and an internal raphe. These fossil seeds represent one of the few fossil records of Eurya in East Asia. This new finding therefore largely extends the distributional ranges of Eurya during Neogene. Fossil records summarized here show that Eurya persisted in Europe until the early Pleistocene, but disappeared thereafter. The genus might have first appeared in East Asia no later than the late Oligocene, and dispersed widely in regions such as Japan, Nepal, and southwestern China.

1. Introduction

Eurya Thunb. is a large genus of the tea family Theaceae, comprising approximately 130 species (Min and Bartholomew, 2007). Its extant species are mainly distributed in tropical to subtropical Asia, and in the western and southern Pacific Islands (Min and Bartholomew, 2007), with a few species in tropical regions of the New World (Łańcucka-Środoniowa, 1966). They are evergreen shrubs, small trees, and rarely large trees, commonly found as dominant understory elements in tropical to subtropical broad-leaved evergreen forests (WGVY, 1987; Min and Bartholomew, 2007).

Although Eurya is not distributed in Europe now, its fossil record is especially rich in this continent, where at least 12 extinct species from the Late Cretaceous to early Pleistocene have been documented (Mai, 1960, 1971; Knobloch, 1977; Łańcucka-Środoniowa, 1981; Friis, 1985; Knobloch and Mai, 1986; van der Burgh, 1987; Friis et al., 2011; Martinetto et al., 2015). Unlike Europe, the fossil occurrences of Eurya in East Asia are rather scarce (Tanai and Uemura, 1991; Momohara, 1992; Momohara and Saito, 2001; Yamakawa et al., 2015), even though this region shows the highest species richness of the genus today. Although molecular data can explain the emergence and diversification of Eurya (Wu et al., 2007), the lack of fossil evidence limits further understanding of the evolution and establishment of its high modern species diversity in East Asia.

In this study, we report a new fossil record of Eurya based on three-dimensionally preserved seeds from the late Pliocene of northwestern Yunnan, southwestern China. We perform detailed morphological and anatomical examinations of these fossil seeds,
and discuss the paleobiogeographic implications of this new fossil finding.

2. Materials and methods

2.1. Fossil site and geological horizon

The present fossil seeds were collected from deposits at Nanbanbang Village, Heqing Basin, northwestern Yunnan Province (26°31′ N, 100°10′ E; 2200 m a.s.l.; Fig. 1). The Heqing Basin is located at the southeastern fringe of the Qinghai-Tibet Plateau within the renowned Hengduan Mountains. It is a tectonic default basin surrounded by mountains with a distinguishable vertical vegetation belt spectrum (Shen et al., 2007). The local climate is primarily influenced by the Indian Monsoon, which is characterized by warm, wet summers and cool, dry winters (Xiao et al., 2010; An et al., 2011). The section studied is unconformably overlain by Quaternary deposits and is composed of horizontally laminated carbonaceous layers imbedded by fine gray sandstones. These carbonaceous layers contain abundant plant remains, mainly fruits and seeds. The age of the carbonaceous layers was previously assigned to the early Pleistocene (Zhu et al., 2016). The latest geological survey shows that the underlying sedimentary layers beneath these carbonaceous layers contain abundant leaf fossils dominated by evergreen sclerophyllous oaks (*Quercus* sect. *Heterobalanus*). In northwestern Yunnan, the dominance of evergreen sclerophyllous oaks in a fossil flora is a common indicator of the Sanying Formation (Tao, 1986), which has been determined to be the late Pliocene based on stratigraphic correlations, palynological information, mammal fossils, and paleomagnetic data (Tao and Kong, 1973; Tao, 1986; Ge and Li, 1999; Su et al. 2011; Li et al., 2013). Therefore, the age of the present fossil seeds and fruits is assigned to the late Pliocene.

2.2. Fossil materials and examination

More than 1000 specimens of charcoalfied fruits and seeds were collected from the fossil site. Among them, more than 80 seeds and seed fragments of *Eurya* were identified through observations under a binocular microscope (Leica, S8AP0). The fossil seeds were cleaned by an ultrasonic cleaner at 40 kHz (KO-50M) for 5–10 s. Air dried, they were then observed under a 3D Super Depth Digital Microscope (ZEISS Smartzoom 5) and images were taken. Five seed specimens were further studied under a scanning electron microscope (SEM, Zeiss EVO LS10) both morphologically and anatomically. For comparative analysis, extant seeds of *Eurya* obtained from herbarium specimens housed at the Herbarium of Kunming Institute of Botany (KUN) were also examined using the same procedure as the fossils. The descriptive terminology mainly follows Friis (1985). All studied fossil specimens are numbered and kept at the KUN.

3. Systematics

**Family:** Theaceae Mirb., 1816  
**Genus:** *Eurya* Thunb., 1783  
**Species:** *Eurya stigmosa* (Ludwig) Mai, 1960  
**Fossil specimens:** NBB 020 (Plate I, 1), NBB 021 (Plate I, 2), NBB 022 (Plate I, 3), NBB 023 (Plate I, 4), NBB 024 (Plate I, 5), NBB 025 (Plate I, 6), NBB 026 (Plate I, 7), NBB 027 (Plate I, 8), NBB 028 (Plate I, 9), NBB 029 (Plate I, 10), NBB 030 (Plate I, 11), NBB 031 (Plate I, 12), NBB 032 (Plate II, 1, 8), NBB 033 (Plate II, 1, 8), NBB 034 (Plate II, 1), NBB 035 (Plate II, 4, 6, 7), NBB 036 (Plate II, 5, 9, 10, 11, 12), and NBB 037.

**Fossil locality:** Nanbanbang Village, Heqing County, northwest Yunnan Province, southwest China (26°31′ N, 100°10′ E; 2200 m a.s.l.)

**Stratigraphic horizon:** The upper Pliocene Sanying Formation

**Description:** Seeds are slightly campylotropous, laterally flattened, and subcircular to slightly angular in outline (Plate I). They are 1.07–2.02 mm in length and 1.03–1.96 mm in width, with a length–width ratio of 0.82–1.32. The seed surface is foveolate with funnel-shaped cells (Plate II,1–4, 6), which are concentrically arranged around the condyle-raphe region in 8–12 rows parallel to the seed margin (Plate II, 1–4, 6). The cells are 0.03–0.15 mm (0.08 mm on average) in diameter, with thickened and finely pitted inner periclinal and anticlinal walls (Plate II, 7), and with cell lumens that gradually narrow towards the base with...
polygonal facets (Plate II, 6–7). The cavity of each seed valve is subdivided by a characteristic reversed and slightly curved V-shaped condyle into a reniform or horseshoe-shaped embryo cavity and raphe (Plate II, 10). The condyle consists of two limbs with equal length but unequal width, which extend from the seed base to almost half of the seed width (Plate II, 10). The raphe is

**Plate I.** Fossil seeds of *Eurya stigmosa* from Nanhanbang under the 3D Super Depth Digital Microscope. Scale bars = 0.5 mm for all images. **T** = tegmen.
marked by a subtriangular cavity, and is formed by the encompassment of the condyle and seed basal margin. The hilar scar is oblong and located between the raphe and micropyle. The seed internal surface is covered by elongated elliptic and slightly thickened cells, which are concentrically arranged around the condyle in rows parallel to the seed margin (Plate II, 9–10). The seed wall is 0.06–0.16 mm thick, sclerotic, composed of a thick exotesta, with large cells, and a thin endotesta, with small cells (Plate II, 5). The thin, membranous remains of the tegmen can be observed attached to the external surface of testa in several seeds (Plate I, 12).

**Morphological comparisons:** Although seeds of *Eurya* are seemingly similar to those of its relatives, such as *Adinandra* W. Jack, *Cleyera* Thunberg, and *Freziera* Willd, they can be reliably distinguished from these genera by key structural details (Friis, 1985; Table 1). Generally, *Eurya* seeds are characterized by a reticulum of funnel-shaped cells with polygonal facets on the external seed surface (Friis, 1985). This diagnostic feature is consistent with our fossil seeds, which differs from the other three genera. Moreover, our fossils also share some other important anatomical features with extant *Eurya* seeds, such as the reniform or horseshoe-shaped embryo cavity, the prominent condyle in the seed valve, and the position of raphe and hilum (Friis, 1985). All of these traits suggest that our fossil seeds can be ascribed to *Eurya*. Among the examined modern seeds of *Eurya*, *Eurya yunnanensis* shows the greatest resemblance to the fossil seeds under study. However, the fossil seeds are distinct from this species by

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**Plate II.** Fossil seeds of *Eurya stigmosa* from Nanbanbang under the SEM. Scale bars = 0.25 mm for 6 and 8; 0.05 mm for 7, 9, and 12; 0.1 mm for 5 and 11; and 0.5 mm for 1–4, and 10. 1–4. General shape of the fossil seeds. 5. Longitudinal section of the seed wall showing the two distinct layers consisting of large cells of the exotesta and small cells of the endotesta. 6. External surface of the seed showing the concentrically arranged cells. 7. Details of the cells on the seed external surface, showing the funnel-shaped and strongly thickened cells of the testa with finely pitted walls. 8. Cells on the center part of the seed external surface, showing the compact, less visible cell lumens and thicker walls. 9. Internal surface of the seed showing elongated elliptic and slightly thickened cells, which are concentrically arranged around the condyle. 10. Internal view of the seed showing the reniform or horseshoe-shaped embryo cavity, reversed and slightly curved V-shaped condyle, subtriangular raphe cavity, micropyle, hilum, and chalaza. 11, 12. Details of the condyle showing the clavate cells. ex = exotesta, en = endotesta, c = condyle, ch = chalaza, h = hilum, m = micropyle, r = raphe.
their slightly larger size, finely pitted cells on the seed external surface, and the difference in cell types on the condyle and seed internal surface (Plates II and III).

| Genus     | Seed general shape                                      | Exotesta Cell shape | Exotesta Cell wall | Endotesta Layers of crystal cells | Seed draft |
|-----------|--------------------------------------------------------|---------------------|--------------------|-----------------------------------|------------|
| Adinandra | Slightly campylotropous                                 | Not funnel-shaped   | Equally thick      | One to several layers             |            |
| Cleyera   | Strongly campylotropous, usually larger than those of the other three genera | Not funnel-shaped   | Equally thick      | Usually one layer                 | –          |
| Eurya     | Slightly campylotropous, or more rarely anatropous      | Funnel-shaped       | Strongly thickened | One or two layers                 | Rather thin|
| Freziera  | Usually anatropous or slightly campylotropous           | Not funnel-shaped   | Equally thick      | Several layers                    | Strongly thickened |

Fossil seeds of *Eurya* that have previously been described are largely from Europe (Chandler, 1963; Mai, 1971; Knobloch, 1977; Łańcucka-Srodoniowa, 1981; Friis, 1985; Knobloch and Mai, 1986; Table 1

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| Eurya     | Slightly campylotropous, or more rarely anatropous      | Funnel-shaped       | Strongly thickened | One or two layers                 | Rather thin|
| Freziera  | Usually anatropous or slightly campylotropous           | Not funnel-shaped   | Equally thick      | Several layers                    | Strongly thickened |

**Plate III.** Extant seeds of *Eurya yunnanensis* under the SEM. Scale bars = 0.25 mm for 3 and 5; 0.05 mm for 1, 4, 7, and 8; and 0.5 mm for 2 and 6.1. Longitudinal section of the seed wall, showing the two distinct layers consisting of large cells of the exotesta and small cells of the endotesta. 2. General shape of the seed and the cells concentrically arranged on the external surface. 3, 4. Details of the cells on the seed external surface, showing the funnel-shaped cells of the testa with smooth surface. 5. The condyle structure and the elongated polygonal cells on the internal surface of the seed which are concentrically arranged around the condyle. 6. Internal view of the seed showing the reniform or horseshoe-shaped embryo cavity, reversed and slightly curved V-shaped condyle, subtriangular raphe cavity, micropyle, hilum, and chalaza. 7. Details of the condyle showing the elliptic or subcircular cells. 8. Details of the cells on the internal surface of the seed, showing the thin and raised cell wall. ex = exotesta, en = endotesta, c = condyle, ch = chalaza, h = hilum, m = micropyle, r = raphe.
Table 2
Carpological comparisons of fossil seeds between Eurya stigmosa from Nanbanbang village, Heqing county and other fossil species of the genus.

| Taxa                   | Cells on the external surface | Seed size | Shape                          | Testa         | References                        |
|------------------------|-------------------------------|-----------|--------------------------------|---------------|-----------------------------------|
| E. stigmosa (Ludwig) Mai | Large, 0.03–0.15 (0.08 on average) mm in diameter | Medium, 1.07–2.02 × 1.03 –1.96 (1.47 × 1.45 on average) mm | Subcircular, campylotropous, laterally flattened | Thick, 0.06–0.16 mm | This study |
| E. mudensis Chandler   | Large, 0.05–0.2 (0.1 on average) mm in diameter | Small, 1.0–1.5 mm in diameter | More rounded | Thick, brittle | Mai (1971) |
| E. stigmosa (Ludwig) Mai | Large cavitae, 0.05–0.2 (0.1 on average) mm in diameter | Medium, 1.0–2.5 (rarely 3) mm in diameter | Great variable (reniform, broadly oval, sub-triangular, angular to almost circular) | Very oblique oval | Mai (1971) and Friis (1985) |
| E. pollennis (Chandler) Mai | Large, 0.05–0.2 (0.1 on average) mm in diameter | Medium, 1.9–2.3 mm in diameter | More rounded | Thick, brittle | Mai (1971) |
| E. lusatica Mai        | Large cavitae, 0.05–0.2 (0.1 on average) mm in diameter | Large, 2.0–3.2 mm in diameter | Subcircular to obliquely oval | Thick, brittle | Mai (1971) |
| E. becktonensis Chandler | Large, 0.05–0.2 (0.1 on average) mm in diameter | Large, 1.8–4.2 mm in diameter | Elongated oval to obliquely triangular, somewhat angular | Thick, brittle | Mai (1971) |
| E. maii Knobloch       | Large, 0.06–0.13 mm in diameter, eccentric, large (sometimes heptagonal) polygons | Medium, 1.22–2.02 × 0.97 –2.0 (1.62 × 1.38 on average) mm | Roundish-lenticular to oval, more or less compressed | Excessively thick, 0.13–0.22 mm | Knobloch (1977) |
| E. boveyana (Chandler) Mai | Fine, 0.02–0.08 (0.05 on average) mm in diameter | Medium, 1.0–2.0 mm in diameter | Subcircular to oval, more or less rounded, always compressed | Thin, elastic | Mai (1971) |
| E. obliqua (Chandler) Mai | Fine, 0.02–0.08 (0.05 on average) mm in diameter | Small, 1.25–1.7 mm in diameter | Rounded triangular to irregular, always somewhat angular | Thick, brittle, strongly thickened in the central area | Mai (1971) |
| E. dubia (Chandler) Mai | Fine, 0.02–0.08 (0.05 on average) mm in diameter | Medium, 1.25–2.0 mm in diameter | Rounded triangular to irregular, always somewhat angular | Thick, brittle, strongly thickened in the central area | Mai (1971) |
| E. lentiformis (Chandler) Mai | Fine, 0.02–0.08 (0.05 on average) mm in diameter | Large, about 2.5 mm in diameter | Rounded triangular to irregular, always somewhat angular | Thick, 0.08–0.8 mm | Mai (1971) |
| E. crassitesta Knobloch | Fine, about 0.05 mm in diameter, concentric, equal, rounded and annular thickened polygons | Small, 0.8–1.4 × 0.7–1.8 mm | Rounded | Thick, brittle, strongly thickened in the central area | Knobloch (1977) |
| E. hofyi Knobloch      | Fine, eccentric, equally sized polygons | Small, 0.75–1.33 × 0.55–0.97 (1.02 × 0.8 on average) mm | Semicircular, spherical, broadly elliptic, rarely rounded | Thick, 0.08–0.11 mm | Knobloch (1977) |

van der Burgh, 1987; Martinetto et al., 2015), and to a limited extent from Japan in East Asia (Momohara, 1992; Momohara and Saito, 2001; Yamakawa et al., 2015) and Nepal in South Asia (Bhandari et al., 2009, 2010). They are assigned to 12 fossil species and one modern species (Table 3). We compared our fossil seeds with these 12 fossil species using four key characteristics: size of the cells on the seed external surface, seed size, seed shape, and testa thickness (Table 2). Our fossil seeds most resemble the seeds of E. stigmosa (Ludwig) Mai reported from Paleocene to early Pleistocene of Europe (Table 3), that have similar large cells on the seed external surface. Our fossils also have similar seed size (1.07–2.02 × 1.03–1.96 mm) and testa thickness (0.06–0.16 mm) with those of E. stigmosa. Other important seed characteristics, such as the subcircular to slightly angular seed shape, are also shared by our fossils and this species. We have therefore treated our fossils as belonging to E. stigmosa.

4. Paleoecobiogeographic implications

Eurya has a rich fossil record, represented primarily by seed remains and a few leaf impressions (Tao and Du, 1982; Ozaki, 1991; Tanai and Uemura, 1991; Bozukov et al., 2008). The oldest known records of the genus are seed remains from the middle to Late Cretaceous in Austria (Knobloch and Mai, 1986, 1991) and from the Late Cretaceous to Paleocene in the Czech Republic, central Europe (Knobloch, 1977). This may imply a Central European origin. Fossil record also indicates that Europe, where about 12 known fossil species of the genus have been reported, may have been a center for Eurya evolution and diversification in the past (Chandler, 1963; Mai, 1971; Knobloch, 1977; Łańcucka-Środoniowa, 1981; Gregor, 1982; Friis, 1985; Knobloch and Mai, 1986; van der Burgh, 1987; Martinetto et al., 2015) (Table 3; Fig. 2). This hypothesis may be consistent with the warm and humid climate throughout the European Cenozoic (Mosbrugger et al., 2005). Based on the lack of fossil occurrences in the continent after the early Pleistocene, the genus likely disappeared from Europe by that time (Martinetto et al., 2015). This may be largely attributed to the more severe effect of the Quaternary glaciations on Europe compared with relatively low latitude regions (Ehlers et al., 2011).

In contrast to Europe, East Asia has revealed a much lower diversity of Eurya in its geological past. Despite flourishing in the modern era, there are only six documented fossil occurrences of Eurya in East Asia (Tao and Du, 1982; Ozaki, 1991; Tanai and Uemura, 1991; Momohara, 1992; Momohara and Saito, 2001; Yamakawa et al., 2015). The oldest known fossil record is dated to the late Oligocene (Tanai and Uemura, 1991), implying that Eurya probably first appeared in East Asia no later than the late Oligocene. The newly described fossil occurrence represents the first seed fossil record of Eurya in China, and one of the few fossil records of the genus in East Asia. As E. stigmosa has been frequently documented from the Paleocene to early Pleistocene of Europe (Mai, 1971; Łańcucka-Środoniowa, 1981; Gregor, 1982; Friis, 1985; Knobloch and Mai, 1986; van der Burgh, 1987; Martinetto et al., 2015), it may indicate a close affinity between East Asian and European species of the genus. It may suggest the ancient species of East Asian Eurya originated in Europe. The genus may have further dispersed to other regions of Asia, as some other fossil occurrences of Eurya are also reported from the continent, e.g., the late Miocene and late Pliocene of Japan (Ozaki, 1991; Yamakawa et al., 2015), and the late Pleistocene of Nepal (Bhandari et al., 2009, 2010). These
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Table 3
Detailed information on macrofossil records of Eurya.

| Taxa              | Age                     | Fossil type | Locality          | References                          |
|-------------------|-------------------------|-------------|--------------------|-------------------------------------|
| E. sp.            | Late Pleistocene        | Seed        | Central Nepal      | Bhandari et al. (2009, 2010)        |
| E. stigmosa (Ludwig) Mai | Late Pliocene | Seed        | NW Yunnan, SW China | This study                          |
| E. japonica Thunberg | Late Pliocene | Seed        | Central Japan      | Yamakawa et al. (2015)              |
| E. sp.            | Late Pliocene           | Seed        | SW Japan           | Momohara (1992)                     |
| E. stigmosa (Ludwig) Mai | Early Pliocene–Early Pliocene | Seed | N Italy            | Martinetto et al. (2015)            |
| E. stigmosa (Ludwig) Mai | Middle Pliocene        | Seed        | Central Italy      | Martinetto (2001)                   |
| E. stigmosa (Ludwig) Mai | Middle Pliocene        | Seed        | NW Italy           | Basili et al. (1997)                |
| E. stigmosa (Ludwig) Mai | Early Pliocene         | Seed        | NW Italy           | Martinetto et al. (1997)            |
| E. stigmosa (Ludwig) Mai | Pliocene               | Seed        | Germany            | van der Burgh (1978, 1983)          |
| E. sp.            | Late Miocene to Early Pliocene | Seed | England            | Boulter (1971)                      |
| E. ciliata Merrill | Late Miocene to Early Pliocene | Leaf | SW Yunnan, SW China | Tao and Du (1982)                   |
| E. stigmosa (Ludwig) Mai | Late Miocene to Early Pliocene | Seed | SW Poland          | Dyjor et al. (1992)                 |
| E. sp.            | Late Miocene            | Leaf        | Japan              | Ozaki (1991)                        |
| E. lusatica Mai   | Late Miocene            | Seed        | Eschweiler, Germany | van der Burgh (1987)                |
| E. japonica Thunberg | Late Miocene            | Seed        | Central Japan      | Momohara and Sato (2001)            |
| E. stigmosa (Ludwig) Mai | Late Miocene          | Seed        | Eschweiler, Germany | Boulter (1987)                      |
| E. stigmosa (Ludwig) Mai | Middle Miocene         | Seed        | Denmark            | Friis (1979, 1985)                  |
| E. stigmosa (Ludwig) Mai | Early Miocene          | Seed        | Czech              | Teodoridis and Kvaček (2006)       |
| E. stigmosa (Ludwig) Mai | Early Miocene          | Seed        | Austria            | Meller (1998) and Meller et al. (1999) |
| E. stigmosa (Ludwig) Mai | Miocene                | Seed        | South Poland       | Laricucu-Srodoniowa (1966, 1981, 1984) |
| E. stigmosa (Ludwig) Mai | Miocene                | Seed        | Germany            | Gregor (1982)                       |
| E. stigmosa (Ludwig) Mai | Miocene                | Seed        | Germany            | Mai (1960)                          |
| E. lusatica Mai   | Miocene                | Seed        | Germany            | Mai (1971)                          |
| E. aff. acuminatissima Merr. & Chun | Late Oligocene | Leaf | SE Bulgaria        | Bozukov and Palamarev (1995) and Bozukov et al. (2008) |
| E. sp.            | Late Oligocene          | Leaf        | Japan              | Tanai and Uemura (1991)             |
| E. dubia (Chandler) Mai | Middle Oligocene     | Seed        | Devonshire, England | Mai (1971)                          |
| E. dubia (Chandler) Mai | Middle Oligocene     | Seed        | Nerchau, Germany   | Mai (1971)                          |
| E. modenus Chandler | Middle Oligocene      | Seed        | Germany            | Mai (1971)                          |
| E. stigmosa (Ludwig) Mai | Middle Oligocene    | Seed        | Devonshire, England | Mai (1971)                          |
| E. boveyana (Chandler) Mai | Middle Oligocene    | Seed        | Devonshire, England | Mai (1971)                          |
| E. boveyana (Chandler) Mai | Miocene              | Seed        | Germany            | Mai and Walther (1978)              |
| E. boveyana (Chandler) Mai | Miocene              | Seed        | Germany            | Mai (1971)                          |
| E. crassitesta Knobloch | Late Cretaceous to Paleocene | Seed | Moravian Carpathian, Czech Republic | Knobloch (1977)                     |
| E. mai Knobloch | Late Cretaceous to Paleocene | Seed | Moravian Carpathian, Czech Republic | Knobloch (1977)                     |
| E. holty Knobloch | Late Cretaceous to Paleocene | Seed | Moravian Carpathian, Czech Republic | Knobloch (1977)                     |
| E. crassitesta Knobloch | Middle–Late Cretaceous | Seed | Austria             | Knobloch and Mai (1986, 1991)       |

fossils may represent partial histories of the ancient lineages of modern Eurya in Asia.
