BLUMEA 43 (1998) 121–127

THAT ELM AGAIN! ULMUS AT PEA BULLOK, NORTH SUMATRA, AND REGIONAL COMPARISONS

B.K. MALONEY

Palaeoecology Centre, Queen's University, Belfast, Northern Ireland

SUMMARY

Details of a palynological record of *Ulmus* in North Sumatra extending from c. 21,250 B.P. are presented and compared with recent findings from Java and Sulawesi (Table 1).

There appear to be no records of *Ulmus* pre-dating the Pleistocene in Southeast Asia (Muller, 1981; Caratini & Tissot, 1985; Watanasak, 1990). Four-pored *Ulmus* pollen was first reported by Maloney (1984) from the radiocarbon dated sites of Pea Simsim and Tao Sipinggan and the then undated Pea Sijajap record. It was subsequently also found at Sibisa Swamp (Maloney, 1985). More recently, fossil *Ulmus* pollen was discovered at sites in West Java (Stuijts, 1993; Van der Kaars & Dam, 1995). Two cores from Pea Bullok, North Sumatra, have now been analysed and *Ulmus* occurred in two samples, one sample from each core. With 18 radiocarbon dates, the Pea Bullok cores are now the best dated deposits from Indonesia (Maloney & McCormac, 1996) and the older of the two cores, Core A, from the edge of the site, dates back to about 30,000 B. P. at its base, while the section of the core from the centre (Core B) is about 20,000 years old at 3.50 m depth and there is another half metre intact which remains to be analysed and radiocarbon dated at some future time.

Four radiocarbon dates have now been obtained from the short Pea Sijajap core. Its base is about 4000 years old and the single occurrence of *Ulmus* pollen dates to around 2135 B.P. Insufficient organic material is available to date Sibisa.

To recap briefly on the earlier findings, all the North Sumatran sites reported upon, including Pea Bullok, are on the high Toba Plateau. Sibisa Swamp is near Parapat, north of the lake, but the other sites are south of Lake Toba. Pea Sim-sim, Tao Sipinggan and Pea Bullok are all at c. 1400 m altitude. Pea Sijajap is at about one hundred metres lower in the downfaulted Simamora valley to the west of Pea Sim-sim and Tao Sipinggan which are near Lintongnihuta Pardolaan (the new village of Lintongnihuta). Sibisa Swamp is also at about 1300 m altitude.

Pea Bullok is located approximately 2 km north of Siborongborong on the east side of the road to Balige. The site appears to be an extinct volcanic crater and it is infilled to the rim with peats. Unfortunately, because of the amount of wood in the stratigraphy, it was impossible to obtain a complete core to the base of the deposit either from the

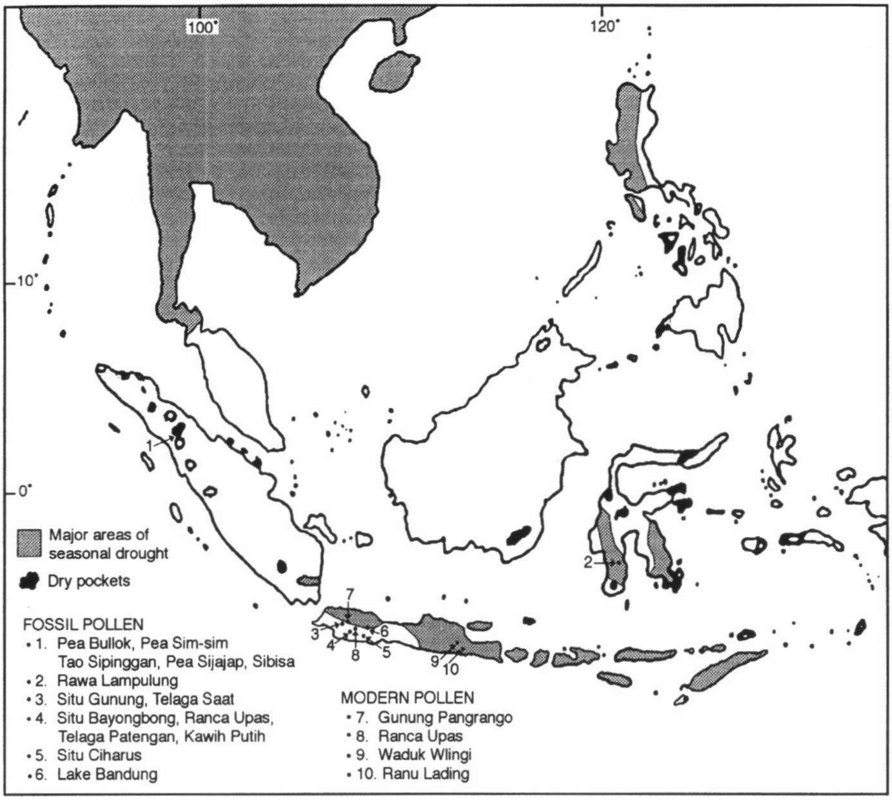

Fig. 1. Location of pollen sites mentioned in the text and major areas of seasonal drought (hatched) and dry pockets (dots). Base map adapted from Van Steenis (1979: 107, fig. 5).

centre or the edge but since there is approximately 30,000 years of peat accumulation at the edge, it is likely that the crater formed during the last major eruption of Toba which has been dated (Chesner et al., 1990) at c. 74,000 B.P.

One species of elm, *Ulmus lanceifolia* Roxb. ex Wall. (Touw & Van Steenis, 1968) has been reported from the Toba area but no *Ulmus* has been found in Java (Backer & Bakhuizen van den Brink, 1965), although it does occur in Flores and Sulawesi (Soepadmo, 1977). Van Steenis (1979: 145) stated that where *Ulmus* was present in the Lesser Sunda Islands it was in localised wet pockets and may be a chance relict of a former much richer and more extensive rain forest flora rather than a new invader.

The record from Pea Sim-sim, the older of the previously analysed sites from North Sumatra, showed that *Ulmus* pollen was contributing sporadically to the fossil pollen record from about 16,100 B.P. (this is a revision of the 15,700 B.P. estimate for the 6.75 m depth given in Maloney, 1984) and to the Tao Sipinggan record from the beginning of deposition slightly over 12,000 years ago.

At Pea Bullok one pollen grain was present in a sample which is about 21,250 years old from Core A and another from a level dating to approximately 17,850 B.P. in

Core B sample. Van der Kaars & Dam (1995: 69) dismiss long-distance transport of pollen in their explanation of the findings from Lake Bandung but a sample from Core B contained a pollen grain of *Abies* (identification confirmed by Dr. V. A. Hall). This is extremely unlikely to be a contaminant as no samples containing fir pollen were prepared in our laboratory around the time at which this material was pretreated and sample tubes are rigorously cleaned after use. The pollen grain must, presumably, have been transported out of mainland Asia by the NE monsoon and demonstrates that there has been some long-distance transport of pollen. Schmidt (1974: 187) stated that *Abies* is only found above 22° N in Vietnam (it is present at altitudes of over 2000 m in the Fan Si Pan massif).

Turning to the Javanese reports, Stuijts (1993) found *Ulmus* pollen at two of her sites: Ranca Upas (c. 1750 m), which has a 10,000 year old pollen record, and Kawah Putih (2200 m), which is undatable. *Ulmus* was present in five samples from Ranca Upas including one of probable very recent age and in two samples from Kawah Putih. However, in these instances the pollen grains had between four and six pores, not just four pores as in the case of all the Sumatran elm pollen grains, so the possibility of laboratory contamination by pollen grains from a European source cannot be excluded[1], but Ranca Upas is located only 55 km southwest of Bandung while Kawah Putih is situated about 10 km northeast of Gunung Pangrango. As far as long-distance transport is concerned, Stuijts (1993: 32) found elm pollen in a modern sample from the top of Gunung Pangrango at a height of 3020 m, i.e. where it could have been transported either from mainland Asia or, perhaps, Flores or Sulawesi. Interestingly, *Ulmus* (pollen morphology undescribed) has only been reported once (Gremmen, 1990: fig. 2) from Sulawesi (it has a 0.1% representation in spectrum 27, which post-dates a radiocarbon date of 2610 ± 50 B.P. at Rawa Lampulung). It was not found in any of the 20 surface samples analysed from highland North Sumatra but occurred at trace levels (Beuning, 1996: 16) in two lakes from East Java. This writer is inclined to suggest that here we are probably dealing with long-distance transport of pollen, and this is an alternative explanation for all the North Sumatran finds. Beuning lists this possibility as one of three for her finds. The other two are that elm does grow in East Java and contamination with North American *Ulmus* during chemical pre-treatment of samples. She discounts the latter because of Stuijts' finds.

The same cannot be said concerning the report by Van der Kaars & Dam (1995) from the Bandung area. They tried to make total tree pollen counts of approximately 300, but sometimes it was not possible to count beyond 100. Where *Ulmus* occurred, it ranged up to 5–10% of total tree pollen in cores DPDR-I and DPDR-II, and up to 20% in samples from a quarry section (Van der Kaars & Dam, 1995: 69). Here the likelihood of long-distance transport is remote.

1) Data on the distribution of elm and on the pollen morphology of Asian–Southeast Asian elm species is not plentiful, so it is not possible to state definitively that 5- or 6-pored pollen grains are absent. However, Nair (1965: 39, pl. XIV, fig. 177) states that *Ulmus wallichiana* Planch. is (4-) 5-porate and Huang (1972: 235, pl. 154: 25–30) shows that *Ulmus parviflora* Jacq. has 4 or 5 pores.

Table 1a. Finds of fossil *Ulmus* from Southeast Asia and their estimated ages.

Location	Altitude (m)	Depth (cm)	Percentage of pollen sum	Number of grains	Estimated age (years B.P.)
SUMATRA					
Pea Bullok Core A	1400	465	0.18	1	21250
Pea Bullok Core B	1400	235	0.27	1	17859
Pea Sim-sim	1400	675	0.29	1	15700
		475	1.02	1	12204
		260	0.65	1	8588
		110	0.13	1	3900
Tao Sipinggan	1400	920	0.49	1	12130
		470	1.03	1	3500
		255	0.83	1	1500
Pea Sijajap	1300	65	0.20	1	2135
Sibisa	c. 1300	145	0.18	2	undated
JAVA					
Situ Gunung:					
Ulmaceae	c. 1050	625	0.70	3	6574
		525	0.20	1	5665
		510	0.40	1	5528
		250	0.60	2	4650
		150	0.10	1	2790
		100	0.20	1	1860
Telaga Saat	1450				
Ulmus		210	1.90	2	2221
Situ Bayongbong	1300				
Ulmus		525	0.20	1	11806
Ulmaceae		730	0.30	1	15829
Ranca Upas II	c. 1750				
Ulmaceae		675	0.50	1	8672
		625	0.30	1	8345
		380	0.30	1	5917
		220	0.30	1	4262
Ranca Upas diagram					
Ulmus		75			940
		170			3647
		380			5917
		625			8345
		800			9490
		840			9895
		975			10162
		1025			10360
		1070			
		1120			
		1160			
		1200			
		1275			10380
		1300			
Telaga Patengan I	1575				
Ulmaceae		340	0.30	1	1922
		330	1.00	6	1864

(Table 1a continued)

Location	Altitude (m)	Depth (cm)	Percentage of pollen sum	Number of grains	Estimated age (years B.P.)
Telaga Patengan II: absent					
Telaga Patengan III					
Ulmaceae		1075	0.30	1	4814
Ulmus		1060	0.30	1	4736
Ulmaceae		1040	0.30	1	4630
Ulmus		690	0.20	1	2741
Ulmaceae		720	0.30	1	3000
Ulmus		210	0.40	1	1050
Ulmaceae		160	0.20	1	800
Kawah Putih	2200				
Ulmus		250	trace		
		150	trace		
(Shown on diagram, not tabulated)					
Situ Ciharus I	1525				
Ulmus		1500	0.10	1 (?)	9041
Situ Ciharus II					
Ulmus		370	0.10	1 (?)	1391
Ulmaceae		350	0.10	1 (?)	1289
Ulmus		300	0.10	1 (?)	1036
SULAWESI					
Rawa Lampulung					
Ulmus		540	0.10	1 (?)	1900

Table 1b. Finds of modern *Ulmus* pollen from Southeast Asia.

Location	Altitude (m)	Percentage of pollen sum	Number of grains
Gunung Pangrango	3010	1.00	1
Ranca Upas	c. 1750	0.40	1
Waduk Wlingi, south of Gunung Kelud	110	trace	
Ranu Lading, southwest side of Gunung Lamongan	350	trace	

The pollen sum used to calculate the Sumatran figures was total dry land pollen plus Cyatheaceae while that used for the Javan and Sulawesi samples was total arboreal pollen. *Ulmus* may have been excluded from the Situ Ciharus pollen sum because recalculation using Stuijts' published arboreal pollen totals gives percentages higher than 0.10. The number of pollen grains found is so low that the difference in method of calculating the results is not very important. Raw data from Van der Kaars & Dam's diagrams have not been published and accurate percentages could not be derived from Stuijts' Ranca Upas published diagram so tabulation was not possible. Estimated ages were calculated using the depth of the centre of the sample and disregarding the error of the determination.

Ulmus mainly occurs in the lowland and submontane forests of seasonally dry areas between 200–1450 m altitude (Soepadmo, 1977), although, according to Van der Kaars & Dam (1995) it is present in riparian forest in Thailand (no source given, elm has not yet been considered in Flora of Thailand). Four vernacular names for *Ulmus lanceifolia* Roxb. are listed by Smitinand (1980), and all of them northern. Santisuk (1988: 29) has reported it from the middle tree layer of seasonal forest and (l.c.: 33) the canopy layer of lower montane forest. It is among taxa replacing fagaceous trees in shady ravines of the lower montane forest area (l. c.: 34) although it is not stated to be riverine, but it does grow on valley slopes. Smitinand (1966: 115) found what may be *U. lanceifolia* at c. 1800 m altitude on an open limestone ridge at Doi Chiengdao. Stuijts (1993: 32) records a personal communication from the late Professor van Steenis which stated that *Ulmus* grows in regions subject to some extent to a seasonal climate: Flores, Sulawesi and northern Sumatra. Nevertheless, Van Steenis (1979: 145) noted that *Ulmus* was among rain forest taxa which occurred in local wet pockets in the Lesser Sunda Islands and that these were probably chance relicts of a once much richer and more extensive rain forest flora rather than new invaders. North Sumatra, except the rainshadow area at c. 900 m altitude around Lake Toba, cannot be regarded as seasonally dry.

A pollen indicator for seasonal dryness in island Southeast Asia would greatly aid palaeoclimatic reconstruction. *Ulmus* has relatively high percentages in the Bandung area between about 81,000–74,000 B.P., a drier period, but it is also frequent in a humid period pre-dating 81,000 B.P. The high percentages suggest local occurrence, but, because of possible overlapping dry land-riparian ecologies, the elm on its own cannot be regarded as a reliable indicator of seasonal dryness while its presence at background frequencies during the period of Late Pleistocene cooler conditions in North Sumatra do not justify arguing a case for increased seasonality of climate there, especially as Pea Bullok must have been in the cloud forest belt (Maloney & McCormac, 1996) for at least part of this time. Indeed, if Van Steenis (1979) is correct, it may be a better indicator for the occurrence of localised wetter areas.

REFERENCES

Backer, C.A. & R.C. Bakhuizen van den Brink f. 1965. Flora of Java 2. Groningen.

Beuning, K.R.M. 1996. Modern pollen rain, vegetation and climate in lowland East Java, Indonesia. Modern Quaternary Research in Southeast Asia 14: 1–51.

Caratini, C. & C. Tissot. 1985. Le Sondage Misedor, étude palynologique. Études Géographie Tropicale, Centre Nationale de Recherche Scientifique, Bordeaux.

Chesner, C. A., W. I. Rose, A. Deino, R. Drake & J. Westgate. 1990. Eruptive history of Earth's largest Quaternary caldera (Toba, Indonesia) clarified. Geology 19: 200–203.

Gremmen, W.H.E. 1990. Palynological investigations in the Danau Tempe depression, southwest Sulawesi (Celebes), Indonesia. Modern Quaternary Research in Southeast Asia 11: 123–134.

Huang, T.-C. 1972. Pollen Flora of Taiwan. National Taiwan University, Taipei, Taiwan.

Maloney, B.K. 1984. Pollen of Ulmus (Ulmaceae) in the subfossil record from North Sumatra: a note. Blumea 30: 69–70.

Maloney, B.K. 1985. Ulmus pollen at Sibisa Swamp, North Sumatra (Ulmaceae). Blumea 31: 123–127.

Maloney, B.K. & F.G. McCormac. 1996. Thirty thousand years of radiocarbon dated vegetation and climatic change in highland Sumatra. Radiocarbon 37: 181–190.

Muller, J. 1981. Fossil pollen records of extant angiosperms. Bot. Rev. 47: 1–145.

Nair, P.K.K. 1965. Pollen grains of Western Himalyan plants. Asia Publishing House, London.

Santisuk, T. 1988. An account of the vegetation of Northern Thailand. Geoecological Research 5. Steiner, Stuttgart.

Schmidt, M. 1974. Vegetation du Viet-nam: le massif sud-annamitique et les régions limitrophes. ORSTOM, Paris.

Soepadmo, E. 1977. Ulmaceae. In: Flora Malesiana I, 8: 31–76. Sijthof-Noordhoff, Alphen a/d Rijn.

Smitinand, T. 1966. The vegetation of Doi Chiengdao, a limestone massif in Chiengmai, North Thailand. Natu. Hist. Bull. Siam Soc. 21: 93–128.

Smitinand, T. 1980. Thai plant names (botanical names - vernacular names). Royal Forest Herbarium, Bangkok.

Stuijts, I.-L.M. 1993. Late Pleistocene and Holocene vegetation of West-Java, Indonesia. Modern Quaternary Research in Southeast Asia 12: 1–206.

Touw, A. & C.G.G.J. van Steenis. 1968. Note on Ulmus in Malesia (Ulmaceae). Blumea 16: 84.

Van der Kaars, W.A. & M.A.C. Dam. 1995. A 135,000-year record of vegetational and climatic change from the Bandung area, West-Java, Indonesia. Palaeogeogr., Palaeoclim., Palaeoecol. 117: 55–72.

Van Steenis, C.G.G.J. 1979. Plant-geography of east Malesia. Bot. J. Linn. Soc. 79: 97–178.

Watanasak, M. 1990. Mid Tertiary palynostratigraphy of Thailand. J. Southeast Asian Earth Sci. 4: 203–218.