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COMPARATIVE STUDIES ON DIFFERENT CONCEPTS ABOUT THE ORIGIN OF WRITING ON PALM LEAF
Botany – traditional technologies – divine teachers

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Abstract

Compound leaves of *Phoenix dactylifera* were used as tally stick (Pharaonic Egypt) and for phyllomantic (Cumae). The Arabs wrote on date palm petioles only in pre-Islamic times. Classic writing materials became fan palm leaves of *Corypha umbraculifera* and the multipurpose *Borassus flabellifer* (wrongly believed to be a native of Africa). *Borassus* leaf seems to have been a substitute for the bee wax of tablets and codices used by early foreign partners of the Tamil Hindus in maritime trade. Greek, Indian and Indonesian traditional physico-chemical processing methods for softening, hardening, preservation and scripts for styles and ink pens were evaluated. Low-cost palm leaf promoted literacy and "books in mothertongue" on crafts, healing, lore and religions. Sarasvati, "inventress of Devanagari" and "guardian deity of lontars" was found to compare with Athena and Seshat.

1 Introduction

In India and other countries of South East Asia, sacred and secular texts have been written on palm leaf. Indian experts on manuscriptology have different ideas on the country of origin of these practices. HARINARAYANA from Tamil Nadu (1996:262) wrote: "the use of palm leaf as a writing surface is an ingenious idea of Indian mind", whereas SHETH from Gujarat (1996:97) maintained: "Egyptians were the first to use palm leaf to write their thoughts on". There are also controversial views on the prototype of Indian palm chosen for this purpose. MURTHY (1996:27), JOSHI (1996:277) and PRAJAPATI (1996:287) reported that *śrītāla* (= *Corypha umbraculifera* L.) was adopted first, whereas the *Palmyra palm* or *tāla* (= *Borassus flabellifer* L.) was brought to India from Africa at a late date and then used in a similar way. Their source, the Indologist "Hoernle" is also quoted as main authority in a paragraph on "palm leaf" by GRÖNBOLD

(1999:513) in a German Encyclopaedia on Library Science. PRAJAPATI, a scientific officer from the National Archives of India in New Delhi (p. 288), did not merely copy. He had his doubts when he thought about the different importance of the two palms in the "flora of India" and required "thorough investigation". In a previous paper, I briefly mentioned the first trials of school children from Tranquebar to write with a stylus on *olei* [ōlai], the leaf of the *Borassus* palm, as described in the 18th century by a Tamil teacher to inquisitive German pietists (JAHN 2004:126). Already before, I had seen a postcard published by the Swiss Magazine MUSEION, which shows a young scribe with stylus and wax tablet painted on a drinking bowl from about 480 BC by an ancient Greek artist (cf. § 4.4). Wax tablets for writing were no Greek invention. Royal scribes from Nineveh already used an "écritoire en bois recouvert de cire" (wooden writing table covered with wax) in the 7th century BC (ANDRÉ-LEICKNAM and ZIEGLER 1982:337). Thus it seemed to me, that the Indians discovered palm leaf as the most suitable local substitute of bee wax for incising scripture. Traditional Indian and Indonesian artisans then developed processing methods which also let even *Borassus* leaf compete with papyrus and other "papers" for writing with pen and ink. There are records on the occasional use of the leaves from the date palm (*Phoenix dactylifera* L.) and some other feather palms for writing. We have, however, to search for evidence that such practices could have preceded the uses in India and were not tried out much later. The present paper attempts to investigate the different concepts and the impact of writing on palm leaf for all classes of society. The work is based on literature about botany, physicochemical backgrounds of processing methods for writing materials, ethnography, mythology and history. In addition I obtained valuable information from correspondence with colleagues from various fields as quoted in the text and I also made use of my own experience with the multidisciplinary evaluation of other traditional technologies in tropical countries of Africa and Asia.

2 Systematic and ethno-botany of the palms used for writing purposes

2.1 Classification, ecology and morphological peculiarities

The scientific name of the family *Palmae* is of Greek origin and due to the resemblance between the leaves of these trees and the palm (*παλαμη*) or inner part of the hand with spread out fingers. *Borassus flabellifer* L. and *Corypha um-*

braculifera L., which mainly provided writing material, are from the subfamily *Coryphoideae*. There are three other palms with occasional uses. *Phoenix dactylifera* L. (date palm) also belongs to *Coryphoideae*, *Cocos nucifera* L. (coconut palm) to the *Arecoideae*. The "trunkless" *Nypa fruticans* Wurmb (salt water or mangrove palm) is the only member of the subfamily *Nypoideae* (CAÑIZO 2002:158–162, data from the revised classification by UHL and DRANSFIELD 1997).

Borassus flabellifer L. (syn. *B. flabelliformis Roxb.*) is an Asian palm with a vast habitat extending from India to New Guinea. It survives seasonal droughts in South India and occasional frosts in Northwest India, in latitudes up to 30°N. The best sites for favourable development, however, are dry, low sandy plains in hot regions like in Tamil Nadu. The English name *palmyra palm* (Table 1) is not related to the ancient date palm oasis Palmyra in Syria. *Palmeira* means palm in Portuguese. During colonial times, this name was used in Malabar for the coconut palm and a palm providing *jagra* or sugar (COSTA "Tratado" [1578] chapt. 13), which botanists later called *Borassus* palm. The Portuguese also called this tree *palmeira brawa* (now spelled *brava*) which was rendered in Dutch to *wilde Cocus boom* (RUMPHIUS 1741:47) and by English speakers in Bombay to *Brab tree* (BLATTER 1926:174). *Borassus* palms are dioecious. Some vernacular names of *Borassus flabellifer* indicate the gender. *Ampana* and lontar *manneken* (small man) refer to male plants and lontar *wyfken* (small wife) to female plants. Their male and female inflorescences are enclosed by spathes or large bracts of strongly fibrous structure, which protect the spadices and their branches like a sheath until the sessile flowers are fully developed. Linnaeus knew palms chiefly from literature. The illustrations of *ampana* and *carim-pana* in the Dutch Flora "Hortus Malabaricus" were the lectotype for his typification of *Borassus flabellifer* (MOORE and DRANSFIELD 1979:60, 62). As generic name, he chose *Borassus* a word derived from a Greek term of ancient Semitic origin found in descriptions of the date palm. Dioscurides (1st century AD, I 54, 150), a Greek from Asia minor and physician in the Roman Army, knew the term *borassos* (*βορασσος*) as synonym of *elate* (*ἐλάτη*) or *spathe* (*σπάθη*), although he had no personal experience about the morphology. Thus he wrongly maintained that the *borassos* is "enveloping the fruit of the palm tree" (= *Phoenix dactylifera* L.) and that this name also refers to "date enclosed by a spathe" (CUNY 1918:224)[1].

1 Technical terms from the cultivation of date palms in ancient Mesopotamia became loan words in Greek. *Burāsu* (Babylonian) and *burāšu* (Assyrian) were considered as root of the

Corypha umbraculifera L. (Talipot palm) and *Corypha spp.* are impressive, majestical palms which are found in hot, humid coastal regions of Sri Lanka, the Malabar coast, Bengal, Burma and other countries of South East Asia. The generic name *Corypha* is of Greek origin and means crown of the head or vertex (BLATTER 1926:69). Palms of this genus are hapaxanthous. Flowering and fruiting takes place only once at the age between 20 and 80 years. Then the tree dies. The widely branched inflorescence of *Corypha umbraculifera* – the highest inflorescence in the world – is shooting up about 6 m over the top of the palm (CAÑIZO 2002:506).

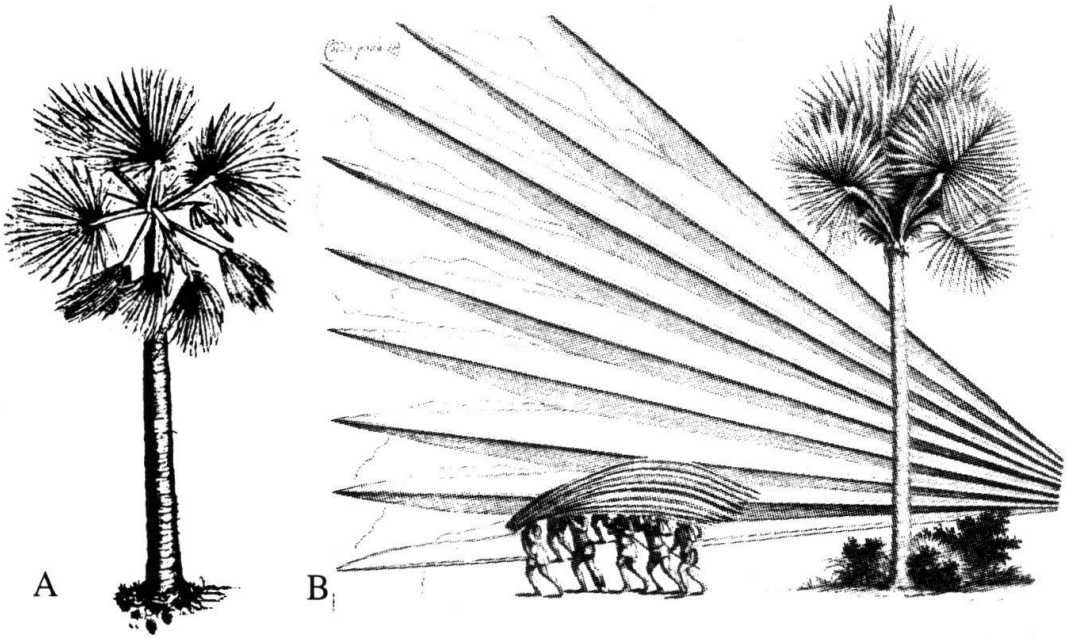

Fig. 1: A: A male "palmyra palm" (*Borassus flabellifer*) with several closed inflorescences; B: The monoecious fan palm *Corypha umbraculifera* with its single [hermaphrodite] inflorescence on top – detail of a leaf – the large leaf must be carried by a group of men. Drawings from vol. 2 (1682) of the Dutch Hortus Malabaricus (Source: MOORE and DRANSFIELD 1979:62, 63).

Borassus and *Corypha* palms belong to the *fan palms. Corypha umbraculifera* is the palm with the largest leaves (Fig. l) with a diameter of up to 5 m (CAÑIZO 2002:60). They provide *umbra* (shade) and shelter and can also "fold close like a lady's fan" (BLATTER 1926:78). The diameter of the less pliable *Borassus* leaves only amounts to 1.5–3 m and they have 60–80 segments. Their parenchyme is more fibrous, has transverse sclerotic partitions and prominent transverse veins.

Greek term *borassos* (CUNY 1918:227–28). Also the Greek word *elate* is of Semitic origin. Palm farmers from the Persian Gulf still call the enclosed inflorescences of *Phoenix persicus* in Arabic *talat* (EIGLER and WÖHRLE 1993:94).

The leaves of *Corypha* are thinner. Their veins are numerous and have a network-like appearance (TOMLINSON 1961:154, 267 and Figs., PADMAKUMAR et al. 2003:126). *Phoenix dactylifera*, *Cocus nucifera* and *Nypa fruticans* belong to the *feather palms.* They have *pinnate* (feather-like), narrow leaves on either side of a central axis.

2.2 Main uses and vernacular names of Borassus and Corypha palms

Borassus flabellifer plays a great role in the traditional life of the Tamils. Apart from *panai,* they call this palm *tāla* (Table 1), recorded as Sanskrit name by MONNIER-WILLIAMS (1899:444). SHETH (1996:97) also quoted *tāle.* Some linguists thought that the word might be of Dravidian origin (Merriam Webster 1993:2403), but *tāla* is derived from a Babylonian name of the [date] palm, as MEISSNER (1902:470) has found. An ideogram for "small palm" in a "Babylonian Syllabar" has the phonetic value of *tālu.* In a Greek text from the 3rd century BC, it was transcribed as *θαλ* (*thal*). *Tale* also means "young palm" in the colloquial Arabic of Iraq. Originally, the name seems to have referred to the enclosed inflorescences of date palms (cf. note 1). Ferguson collected in the 19th century sayings and proverbs in Tamil about *Borassus flabellifer* and asked an English speaking Tamil to translate for him the poem *Tala Vilasam* in which the poet Arunachalam of Terrukkudantai in Tanjore (no biographical data) enumerated 801 different purposes to which a *tala* palm may be applied (BLATTER 1926:202–204)[2]. The most valuable gift of the *Borassus* palm is the sap which also yields syrup, brown sugar, vinegar and in Savu and Roti (Indonesia) even pig swill. This sap is called *neera* (= water) in Tamil. In other Indian languages, palm and sap have the same name: *tala, tar, tada,* rendered to *toddy* in English. Also vernacular Malay names of the palm refer to the sap or *tuak.* In Timor and Roti, *tua-hua* and *tua-hu* mean "palm sap tree". *Borassus* palms are tapped from unripe, bruised inflorescences[3]. Pious Hindus, Buddhists and Muslims only

2 According to Plutarch, there was already a Babylonian hymn on the *360 benefits* of date palms (CAÑIZO 2002:61). The numbers *360* and *800* (+1) used for the praise of the most useful palms are *multiples of holy numbers.* In Babylon, *60* was the number of Anu, the highest God. The deity was supposed to dwell in the 8th storey of the Babylonian temple towers, *8* became later also the number of paradises (ENDRES and SCHIMMEL 1988:172–73, 271).

3 The tapping from inflorescences of fan palms and coconut palms is an advanced Indian technology with minimal adverse effects on the tree. Archaic tapping of date palms from the top or by making holes in the trunk, which is still performed in Tunisian oases, Gomera

drink fresh sap[4]. Male palms were said to produce a sweeter sap which was saved to treat severe emaciation or spitting of blood (RUMPHIUS 1741:48, 50, BLATTER 1926:183, DAVIS and JOHNSON 1987:255, MULLER 1991:226). In Eastern Bali, men who wanted children used to drink fresh sap of the tall *rontal* (*Borassus*) palm to increase their *kama jaya* (white semen) while their wives had to drink sap from "ground-fruits" before intercourse (WECK 1986:107). Many Europeans were only interested in the "*Borassus* liquors" as substitute for beverages from their home countries. Since the 17th century, Dutch and British traders distilled together with native Christians an arrack with high alcoholicity from "fermented toddy" (palm wine)[5], which also had sad social consequences. The vernacular names *jager boom* (Dutch) and *jaggery palm* (English)[6] are derived from *iagra* (*jagra*) which means in India palm or raw sugar.

(Canary islands) and in India with *Phoenix sylvestris* Roxb. (wild date palm), can be harmful or fatal to the trees (CAÑIZO 2002:289, BLATTER 1926:3).

4 *Borassus* sap must be consumed during the first hours after tapping. Traditional methods can keep it fresh for additional time. Tappers of the Tamil Hindus sprinkle slaked lime or *chunam* at the inside of the sap receptacle to prevent fermenting (BLATTER 1926:183). The Muslims of the Indonesian island Madura achieve removal of impurities from the sap with *laro*, a mixture of powdered bark of *Lannea coromandelica* and crushed dry leaves of *Anacardium occidentale*, as observed by DRANSFIELD in 1976. Lime and the "natural coagulants" from the two species of *Anacardiaceae* are also used for the traditional clarification of turbid surface waters (cf. JAHN 1981:70,188). Meanwhile, a company in Madras attempted to process *neera* for sale in the town by filtering, cooling to 0–4°C for 24 hours and sealing it into 200 ml polythene bags (DAVIS and JOHNSON 1987:256).

5 The original recipy for the production of red arrack from the *wijngevende palm* (wine-giving palm) was based on Dutch juniper gin. In Roti it even became the "wine for the holy communion".

6 Palm sugar was in pre-colonial India more important than cane sugar. The consonant presentation *j g r* for *jagar* became s k r in Prakrit and Sanskrit (*sākar*), which was rendered to the terms *sacharum* and *sugar* in Europe (DALGADO 1900:159).

Table 1: Vernacular names of the palms providing writing materials in India and Indonesia

Name	Language	Meaning	References
		Borassus flabellifer L.	
India			
panai	Tamil	panai = palmyra tree	BURROW and EMENEAU 1961, No.3324
nunkuppanai		nunku = tender "palmyra fruit"	No.3065
carim-pana (female plant)	Malayalam	kari = charcoal (black stem), pana = palm tree	NICOLSON, SURESH and MANILAL 1988:278
ampana (male plant)		am from "annu" = male	
palmeira	Portuguese	any palm	Portuguese-English dictionary
palmeira brawa		wild coconut palm	RUMPHIUS 1741:47
brab tree	English (Bombay)	corruption of "brava"	BLATTER 1926:174
palmyra palm	English	palmyra = palmeira (Portuguese)	
tadu	Telugu	tari, tadu = palm sap	NADKARNI 1976:210
tada	Gujarati	(fresh or fermented)	
tar	Hindi, Kannada		
tāla, tāle	Sanskrit		SHETH 1996:97
tala, tada	Prakrit		BURROW and EMENEAU 1961, No.2599
toddy palm	English	palm sap (wine) tree	

Name	Language	Meaning	References
Indonesia			
tua-hua tua-hu	Malay dialects (Timor, Roti)	tua = palm sap hua (hu) = tree	BECCARI 1913:319
lontar, rontal ental, ntal	Balinese	lon from "ron" = leaf in Old Javanese, tal, tar = palm in India	WECK 1986:3, HINZLER 1993:473
lontar wyfken lontar manne-ken	Dutch	wyfken = female manneken = male	RUMPHIUS 1741:45, 47
siwalan [tree]	Javanese	suwala, siwala = letter, *Borassus* leaf (Old Javanese)	WIRYAMARTANA 1993:507, HINZLER 2001:169
jaggery palm	English	jagry (Hindi) = brown palm sugar	Merriam Webster dict.:1208
jager boom	Dutch		RUMPHIUS:45
	Corypha umbraculifera L., *Corypha utan* Lam.		
kudapana	Malayalam	kuda = umbrella, pana = palm	NICOLSON, SURESH and MANILAL:280
sri tada śrītāla	Gujarati Sanskrit	śrī (Sanskrit) = holy, distinguished	SHETH 1996:97
talipot palm	English	pot from pattra (Sanskr.) = leaf	NICOLSON, SURESH and MANILAL:281
gebang, cabang	Javanese	*Corypha utan* or	RUMPHIUS 1741:55
wilde Lontar boom	Dutch	"Lontarus sylvestris"	HINZLER 1993:469

Tapping must be preceded by drastic pruning to give the tapper access to the inflorescences. *Borassus* leaves are used to make vessels for the palm sap and for drawing water, rain cloaks or umbrellas and to thatch rural huts. Once the people even made their clothes from them. Rumphius told us that leaves for writing were mainly collected from male plants. In Java, the palm is called *siwalan* (WIRYAMARTANA 1993:507) which refers to letters written on loose palm leaf called *suwala, sawala, siwala* in Old Javanese (Table 1). In European literature, the most common Indonesian name of the palm and the manuscripts is

lontar, a term derived from *rontal* by folk etymological metathesis. *Ron* means leaf in Old Javanese. In Indonesia, also *tal* (cf. above), which was rendered to *tar*, is believed to be of Javanese origin. The Balinese call the palm *lontar, rontal, ental* and *ntal* (HINZLER 1993:473). *Lontar* is in addition found in the synonym *Lontarus domestica* Gaertn. for *Borassus flabellifer* L.

Tapping of inflorescences of *Corypha umbraculifera*, which appear only in the final stage of this palm, is no common practice. The pith of the trunk yields a kind of sago used by the poor classes, while fish is stupefied with the grounded [poisonous] fruits (NADKARNI 1976:384). Since only the leaves were valuable, the Malayalis called *Corypha umbraculifera* "umbrella palm", quoted as *kuda-pana* (Malayalam script) and *codda-pana* (Latin script) in the Hortus Malabaricus (NICOLSON, SURESH and MANILAL 1988:280). Rumphius told us that only high personalities from the government were allowed to get parasols made from leaves of this particular palm. In Sanskrit and other Indo-aryan languages, the *Corypha* palms share the vernacular name *tala* and its derivations with *Borassus* palms, but they are marked with the prefix *śrī* which means "distinguished" or "holy". Leaves of the species *Corypha utan* Lam. found in Indonesia, were also used for writing. RUMPHIUS (1741:55) recorded for Java the vernacular name *cabang,* more recent authors wrote *gebang*. The Dutch name is *wilde Lontar boom* [wild *Borassus* tree] which was latinized to *Lontarus sylvestris*. In 1930, *Corypha* palms were very rare in Bali, whereas *Borassus* palms grew abundantly in dry areas (HINZLER 1993:438).

2.3 Confusion about African and Asian "Palmyra palms"

2.3.1 Botanical identification of Deleb and Doum palm

The German botanist Martius, a specialist on palms[7], described already in 1838 the morphological differences between the Asian and the African species of the genus *Borassus* and classified the African *Deleb palm* as *Borassus aethiopum* Mart. (CAÑIZO 2002:458). *Deleb* (*delēib*) is the name in the colloquial Arabic of Egypt and the Sudan. In Senegal, the French called this palm *Rondier* (BECCARI 1913:330), a name obviously derived from *rontal* used for *Borassus flabellifer* in Java and Bali. WILLIAMSON (1975:44) described the species as a wild tree of East Africa with different names in tribal languages. In Malawi, the elephants

7 Carl Friedrich Philipp von Martius is the author of the "Historia naturalis palmarum" (I–III, 1823–1850, Leipzig).

like the fruits very much and spit out the seeds which may promote the dissemination. Also the Malawians will still go a long way to collect the fruits.

In all these countries, however, *Borassus aethiopum* is often confounded with *Hyphaene thebaica* Mart., another *Coryphoideae* palm called *dūm* in Arabic and in English *Doum Palm* or *Gingerbread tree* for the sake of the taste of its fruits. The Muslim Arabs cultivate both palms in their gardens and only care for the fruits, whereas Animists or Christians in Malawi also tap the *Borassus* and the *Hyphaene* palm to drink the fresh sap or allow it to ferment to make African palm wine (WILLIAMSON 1975:44, 133). Unlike *Borassus aethiopum*, *Hyphaene thebaica* has been introduced to Asia. In India and Ceylon, "the doum palm may be seen in many a garden" (BLATTER 1926:161, 165).

2.3.2 Hoernle's lacking care for expert advice

The German Indologist Hoernle, still quoted in current Indian and German scientific literature as an important manuscriptologist (§ 1), was the Principal of the Cathedral Mission in Calcutta[8]. He had noticed, that "*Borassus* leaves were not used at all for book writing in Northern India before the end of the 16th century". To find a botanical explanation for his observations, he completely relied on Dr. Prain, the British superintendent of the Botanical Gardens Sibpur close to Calcutta. Reference to Indian or European botanists specialized about *Palmae* or Agroforestry is not made. HOERNLE (1900:94, 112) then wrongly maintained: "*Corypha umbraculifera* is indigenous to India, while *Borassus flabellifer* is an *introduced tree,* having been *brought from Africa,* where it grows wild and is called *Deleb*". His earliest evidence for the arrival of the *Borassus* palm to India (p. 134) was a note on a tree called *tari* (or *tali*) which "gives all the year round a white liquor pleasant to drink" in the *Mirabilia descripta* (1328) by Friar Jordanus. Hoernle heard, however, also about two much earlier eyewitness reports on the cultivation and typical uses of this palm in India. Prof. Hara-Prasad Shastri had pointed out to him an interesting passage in the *Lalita vistara*, a Buddha biography compiled between 200 BC and 200 AD:

> "Just as the exocarp of the *ripe fruit of the Tala palm*, when it drops from its stalk, is of a *brilliant yellow*, even so is the face of the Blessed Gautama perfectly pure".

8 August Rudolf Friedrich Hoernle (1841–1918) was born in Sekundra near Agra as son of a missionary. He went to school in Germany and studied in Basel and London (STACHE-ROSEN 1981:100).

After conferring with Prain, HOERNLE argued (p. 132) that the *Borassus* palm has no yellow fruits. The Swiss botanist BLATTER[9] (1926:187), on the other hand, told us in his detailed description of *Borassus flabellifer*: "Some trees have *all their fruit of a beautiful gold* and others of a very dark colour, and these differences in their colour and other properties have induced the natives (= Tamils) to give them various names". *Al-Biruni*, one of the great Persian scholars of mediaeval Islam, who accompanied Sultan Mahmoud from Ghazna (Afghanistan) on several military expeditions to India (cf. Encyclopaedia of Islam 1960), also mentioned the Indian *Borassus* palm:

> "The Hindus have in the South of their country a slender tree like the date and cocoanut palms, bearing edible fruits, and leaves of the length of one yard and as broad as three fingers, one put beside the other. They call these leaves *tari*, and write on them etc." (in: "Ta'rikh al Hind", completed in 1030).

Hoernle (p. 124) dismissed this evidence too and maintained that although *Alberanu* (= al-Biruni) used the name *tari*, a *Borassus* name, he must have referred to the *Corypha* palm and he also intended to write "bearing *no edible fruits*". For all these inaccuracies, the author or scribes and translator [Sachau, 1879] were blamed, because "as the *Borassus* palm is out of question, he [= al-Biruni] must either have made a slip or the text of his work is handed down incorrectly".

2.4 Uses of leaves and petioles of feather palms for writing

2.4.1 Oracle practices in Cumae and Hellenistic Egypt

Phyllomantic or fortune telling with leaves was common in ancient Greece. "Sycomantic" with fig leaves and mantic with oak leaves were used in the oldest oracles of Delphi and Dodona. Another famous Greek oracle, which had its heyday about 500 BC, was found in the Italian colony Cumae. The Sybil of Cumae

9 Ethelbert Blatter SJ (1877–1934) was born in the Swiss castle Rebstein (Appenzell). Under the guidance of his mother, he already collected plants as a child. After a noviciate and further studies in the Humanities and Botany, he became a professor of Botany in St. Xavier's College in Bombay (1903). The British government funded his fieldwork in India. Hindus, Parsees and Muslims venerated the Christian scholar as a "Mahatma" (great soul). Unfortunately he had to resign from the College in 1924, after it had been transferred to Spanish Jesuits, for whom he was "too liberal" (CORREIA-AFONSO 2001:460, Clausen (1985) according to pers. comm. by Prof. Klaus Schatz SJ, Faculty of Theology, St. Georgen, Frankfurt). Blatter was not able to comment on Hoernle's article, because the publication was not at his disposal, but he mentioned the title (BLATTER 1926:193).

wrote pieces of prophecy on palm leaves. Since inscribed leaves were sometimes scattered if a blast had pushed open the door of the grotto, the wind was believed to interfere as well with the lot oracle (BÄCHTOLD-STÄUBLI and HOFFMANN-KRAYER [eds.] 1987 vol. 7:21). A Greek-Egyptian magic papyrus from the 3rd century AD (Oxyrhynchos Papyri VI, London 1908) recommends to write the "names of the Gods" on palm leaves for prophesies. These 29 names were identical with 29 letters of an alphabet (DORNSEIFF 1925:71). In Cumae and Egypt the concerned palms must have been date palms.

2.4.2 Remark by Plinius and writing material of Egyptian gods

Plinius the Elder (23–79 AD) wrote that "the most ancient way of writing was upon the leaf of the Palm tree" (BLATTER 1926:193). The original quotation in his Natural History (Lib. XIII, cap. 69) reads: *in palmarum foliis primo scriptitatum* and belongs to a text on Hellenistic Egypt:

> As reported by M. Varro [= Marcus Terentius Varro, 116–27 BC], also the paper [papyrus] was invented as a result of Alexander the Great's victory, namely after the foundation of Alexandria. Before, it had not been in use. At the beginning, palm leaves were used for writing, later the bast of certain trees [...] (KÖNIG 1977:138, 139).

Varro and Plinius could not yet know, that papyri already existed in the ancient Empire. They had perhaps a vague idea about writing on palm leaf and the bark of the birch *Betula utiles* (*bhurja-patra*) in India (cf. MURTHY 1996:31). It is, however, also possible that Plinius referred to writing materials attributed to Egyptian gods in texts and temple decorations dealing with the coronation and jubilees of Pharaohs such as Amenophis III and Ramses II. An attribute of *Thoth*, the keeper of the divine archives and "counter of years", is a palm rib which he uses like a tally stick to incise a mark for each year of a king's reign (Fig. 2). *Thoth, Seshat,* his sovereign or wife and the creator god *Atum* also write the name of the ruling Pharaoh on leaves of the sacred *Ished* tree[10] (BONNET 2000 [repr.]:398, 699, 808, Fig. 100, 102 [according to Lepsius]). Instead of "palm rib", also the terms "long palm shoot" and "long palm leaf" have been used (AMES 1965:85). Besides, the hieroglyph with the phonetic value *rnp* has been interpreted as a "leafless date palm branch in which notches for measurements were made" (Fig. 3). The Egyptian word for year *rnpt* is related to it (BETRÒ 2003:136). Egyptologists do not have any evidence that palm leaf has

10 The *Ished* tree, depicted as a broadleaved tree, is a "tree of life" (BONNET 2000:84).

been used as writing material by ancient Egyptian scribes (Poethke, Egyptian Museum Berlin, pers. comm. 2004).

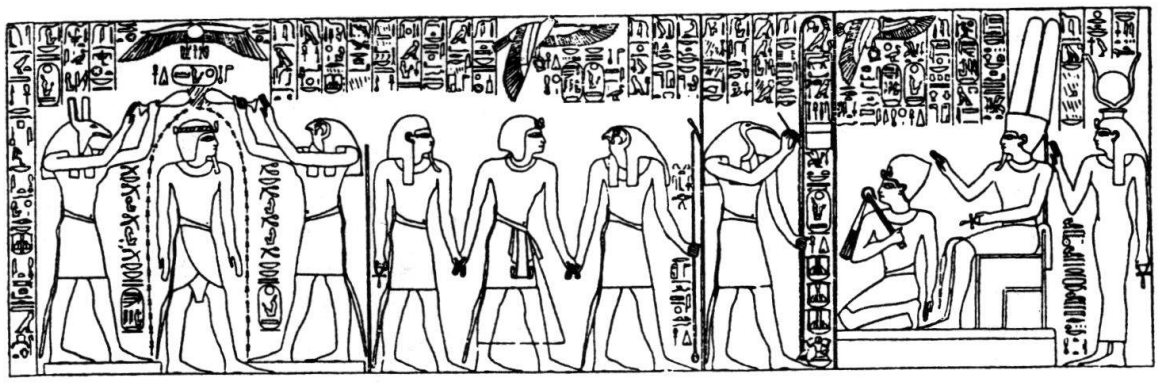

Fig. 2: The Ibis-headed god Thoth incises the first year of reign in a palm stalk at the coronation of pharaoh Amenophis III (Source: BONNET 2000 [1952]: 397).

2.4.3 Arab poetry and Koran texts written on date palm petioles

Many centuries later, leaf-material from date palms (*Phoenix dactylifera* or *Phoenix* spp.) was really used for writing in areas close to India. Arab "traditionalists" reported in the beginning of the Islamic era that "branches from date palms" (*ʿusub an-nahl*) were an occasional writing material in pre-Islamic times (GROHMANN 1967:93). We even know the region where it was used from the Divan of the poet Imruʾal Qais from Basra, who died about 550 AD. In poem 63, verse 1 (AHLWARDT 1870:159), he compared traces in the sand left from an abandoned Bedouin camp to writing on "Yemenite palm leaf" (*ʿasīb yamānī*: عسيب يماني). Apart from "palm leaf" and "palm branch", the writing material *ʿasīb* (pl. *ʿusub*) was also interpreted as the "lower thick end of a palm branch" which has a length of about 50 cm and a width of 4–5 cm. The leaves of the date palm are too coarse and have at best a width of 1.5 cm (MORITZ 1913:402), which may be a reference to the lamina at either side of the midrib. The mentioned stalk, called *petiole* by the botanists (Fig. 3), joins the composite leaf with the stem. During the lifetime of the Prophet, scribes mainly preserved sayings of the Koran on pieces of ordinary red (brown) leather, not on parchment. Occasionally they were also written on "palm branches" which seems to mean "petioles". A fair copy of such temporary records was later written on the costly papyrus by the secretary of Abu Bakr. Also a circular letter from the Prophet to Arabian tribes of the Banū ʿUḏra is sometimes said to have been written on a "palm branch" (MORITZ 1913:402, GROHMANN 1967:70, 93–94).

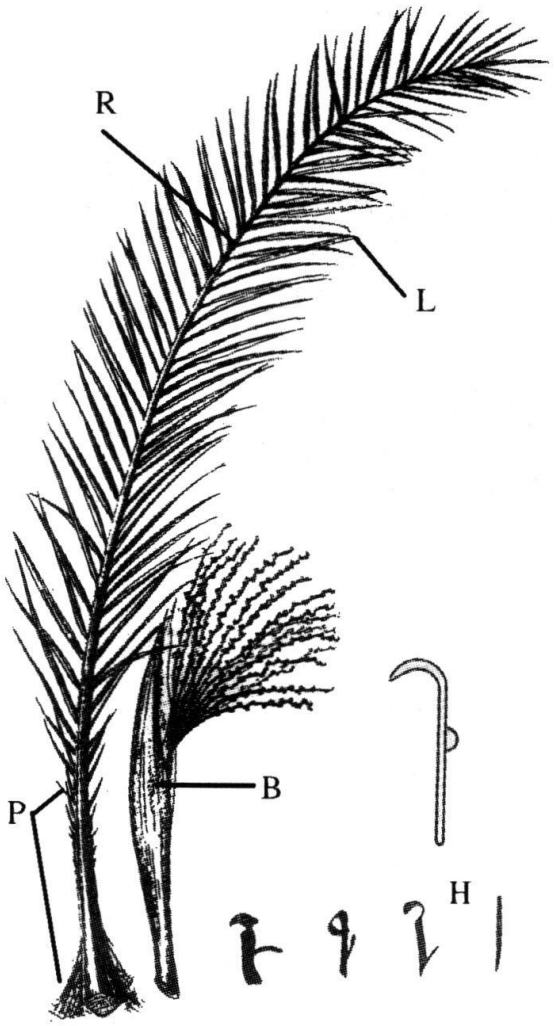

Fig. 3: Leaf and inflorescence of the date palm (*Phoenix dactylifera*) and their "nomenclatures":
R = *rachis* or main axis of the pinnately compound leaf (*palm rib* of Thoth);
L = *leaflets* (*palm leaves* for Greek phyllomantic);
P = *petiole* – the lower still broader part missing in the drawing – (*ʿasīb* of the Arabs);
B = open *bract* of the inflorescence (*borassos, elate, spathe* of the Greeks);
H = *hieroglyphe* for leafless *palm branch* to measure the years.
(Sources: CAÑIZO 2002, part of Fig. 239, p. 294, BETRÒ 2003:136.)

2.4.4 Sporadic use of leaf from coconut and Nipah palms

Occasional writing on the coarse "ola" (leaves) of the *Calappus boom* (= coconut tree) instead of on leaves of the *Borassus* palm has been reported by RUMPHIUS (1741:48). In West Java and in the scriptoria of the Merapi-Merbabu mountains, manuscripts were at the beginning written on thin *Nipah* palm leaves. The generic name of *Nypa fruticans* is derived from its Old Javanese plant name. Later, the *Nipah* leaves were abandoned in favour of *Borassus* leaves. At present, Nipah palms are hardly seen in Java, but they are found in Lombok and Sumbabwa (TEH GALLOP 1999:16, HINZLER pers. comm. 2004).

3 Technological aspects

3.1 Criteria for the choice of the most suitable palm leaf

The success of traditional technologies depends on the availability of the principal raw material, its practical advantages and how much the users can afford. Tamils of all classes of society primarily used *palmyra* (*Borassus flabellifer*) leaves because "they are available in plenty in all places of Tamil Nadu and are not costly" (SUBRAMANIAN 1996:169–170). In 1983, as many as 40 million *palmyras* were estimated to be growing there (DAVIS and JOHNSON 1987:247). *Palmyra* trees are also found abundantly in Orissa where "writing on palm leaf was widely prevalent" (BISOI 1996:46,48). In Bengal, where "Palmyra trees are seldom available", *Corypha umbraculifera* leaves were mainly used for manuscripts (MAHAPATRA 1996:22). The same preference of the thin, beautiful *śritada* leaves which "can be handled like paper" was found in Gujarat (SHETH 1996:98). Scribes in Bali maintained on the other hand, that the *lontar* palm (*Borassus flabellifer*) provided better writing material than *gebang* (*Corypha utan*). The best *Borassus* palms in the island grow in dry foothills close to the coast in the northern regency Buleleng. Palm trees with leaves of an inferior quality are found in the wet area of Selat, on the uphill slopes of Mt. Agung (HINZLER 1993:444, 1999:28). According to experience from Kerala, the best time to harvest *Corypha* and *Borassus* leaf for writing is during summer, four months after the emergence of the young leaves. Certain people collect them on the full moon day (PADMAKUMAR et al. 2003:127). In Java, however, people believe that the "best *lontar* leaves" are obtained before the full moon in September/October or March/April. Leaves cut in other seasons are either not yet fully developed or too old (HINZLER 1993:443–444).

3.2 Methods and technical evaluation of palm leaf processing

3.2.1 Studies on bee wax, a possible precursor of palm leaf

We know from literature since the 5th century BC how Greek artisans attempted to modify available wax types for the different needs of the scribes. These efforts went on in medieval and modern Europe. Data from old and more modern recipies and reports on bee wax for writing have been recently compared to physico-chemical analyses by Dr. Hermann Kühn (München), who worked with samples of wax tablets from the 1st to the 18th century AD (BÜLL et al. 1968:796ff.,808ff.,Table 1). Speedy writing of notes required great plasticity.

Softening of the writing surface was achieved by boiling the wax in large cauldrons with oils (olive-, linseed-, poppy oil), butter and glyceride-containing tallow or also with sodium carbonate to induce the formation of sodium salts with wax acids. It is more difficult to write on hard wax, but the appearance of script and preservation of texts are much better. Boiling with lime yielded harder wax. *Hardening* was also achieved with resin from the wood of certain trees or tar used for shipbuilding. Tar, soot or bone black provided a black colour to the wax. Other dyes were verdigris, lapis and ochre. Writing on wax needed a carrier, which was usually a wooden tablet. Only wealthy clients could afford ivory. To coat a tablet simply with a wax layer was not satisfactory. It was far better to hollow it out. Kings, aristocrats and priests employed special craftsmen, later called "Tafler" or "tabletiers" to make the tablets and fill them with wax. Poor people did everything on their own and tried to recycle the materials as long as possible. Herondas (2nd or 3rd century BC) told us that the Greek schoolboys had to restore the wax surfaces between exercises. A report from the beginning of the 12th century mentions a headmaster of a monastery school who also had to manufacture wax tablets and styles for his boys (BÜLL et al.:787).

3.2.2 Traditional processing of palm leaf (India, Indonesia)

Although palm leaf does not need a special carrier, softening or hardening have a similar importance for the writing surface as in case of the wax for tablets. The Tamils wrote exercises or letters on tender leaves of *Borassus flabellifer* which were only dried in the shadow, cut to strips and carefully smoothened with a conch or a burnishing stone. Simple quality tests allowed to improve the product. If a "zero" could be easily written on a leaf from a certain batch, the processing was successful. In case that the leaf had not dried enough, the stylus got stuck. This meant that drying had to be continued. A harsh sound heard during writing indicated that the stylus might pierce the leaf or split it up. The leaves had to be soaked in water and were dried once more (SUBRAMANIAN 1996:171). Since *Borassus* leaf is often liable to brittleness, it was rubbed before use with *gingelly oil* (oil from the seeds of *Sesamum indicum)* or other oils. This has a softening effect and facilitates speedy writing. Also glycerine can increase the flexibility (BISOI 1996:48, SHETH 1996:98, HARINARAYANA 1996:265, 270). In Bengal, a paste of boiled tamarind seeds [which also contain oil], was used for softening and to prevent unwanted spread of ink. A paste of rice was also used for this purpose, but rice can bring about the growth of fungi and "Hindu religious restrictions never permit any sort of touch of boiled rice with sacred or any

kind of reading material" (MAHAPATRA 1996:26). Use of palm leaf for "books" requires durability and hardening. There were perhaps specific treatments for *Borassus* and *Corypha* leaves which differ with respect to histology (§ 2.1), but the information compiled by the Indian manuscriptologists and the foresters from Kerala is rather contradictory about this subject. The methods comprised: to burry dried palm leaves either in mud for three months, in muddy swamps or in lime (BISOI 1996:48, SHETH 1996:98, PADMAKUMAR et al. 2003:127). Others preferred to boil them in copper vessels, with spring water, mixtures of water with cow dung or with milk and a sufficient quantity of turmeric paste (SATYAWANI 1996:126, VIJAYAN 1996:165, MAHAPATRA 1996:26, PADMAKUMAR et al. 2003:127). The subsequent drying process has not been described in detail. The colour of the leaves became golden after exposure to cow dung. After mud it became brown. Turmeric extracts (root of *Curcuma longa*) yielded a yellowish colour and thereby accentuated the blackened letters.

In Bali, the processing of *Borassus flabellifer* leaves for writing has been investigated in the 1930s by a Dutch controller of the regency Karangasem. Further studies were recently carried out by the archaeologist Hedi HINZLER (1993:446ff., 1999:28), who also provided drawings depicting the required tools and artisans at work. *Borassus* leaves for less important texts are only soaked in water to straighten them and then dried in the sun for bleaching. Leaves for manuscripts get their durability by a process called *mubad, masipat* or *mawilah* in Balinese which means "treated with herbal remedies". For this purpose they are boiled with bark from the *intaram* tree (*Azadirachta indica*)[11], coconut milk, root of *Curcuma longa* and other herbs and then flattened in a wooden press for at least 15 days to expel the plant sap. The most pliant and smooth writing material, however, can be only obtained if this flattening goes on for one or even two years. To facilitate writing, horizontal lines are drawn in advance by pressing 4–5 threads, mounted on a wooden frame, against the palm leaf strips. In India, these threads were blackened with the soot from the bottom of a rice pot (MURTHY 1996:117), in Karangasem they are dyed with the bluish sap of leaves from a kind of *Erythrina.* After inscription, the lines can be easily removed with a piece of wet cotton (HINZLER:450).

11 The use of the bark of *Azadirachta indica* in Indian folk medicine is not due to insecticides but to the presence of adstringent tannins (cf. Chopra et al. 1956:31–32, NADKARNI 1976:784), which may also tighten the palm leaf tissues. Ferguson maintained that the texture of well prepared, palm leaf resembles parchment (BLATTER 1926:194).

The processing of palm leaf was carried out by people from different social classes depending on uses and religious traditions. In Tanjore (Tamil Nadu), where many religious leaders in the 18th century proudly called themselves "Sudra-Brahmins", also most teachers in elementary schools belonged to this low caste. They were skilled like craftsmen and taught the children not only how to write on palm leaf but also how they could produce this writing material on their own. A colorated drawing of a classroom of a "Malabarian school" in Tranquebar (1732) shows a schoolboy working with brownish palm leaf cut to size. Above him, two bigger pieces of green *Borassus* leaf are hanged up to dry on a line (GRÜNDLER and ZIEGENBALG (ed. LIEBAU) 1998: colour plate 3, 137, 265, 325). The Indian manuscriptologists did not comment on the caste of the artisans who processed palm leaf in their region. We may assume, that well-processed palm leaf from Southern India became a trade product sold to other provinces and that artisans who had worked in this field were also called to teach their craft elsewhere in India, Ceylon, Java and Bali. Yet soon, local adaptations and modifications were made. The palm leaves for the royal centres in Bali were in 1939 manufactured by artisans belonging to Balinese families of the highest caste. It is not known, whether members from lower castes were involved in the production of inferior writing material from the trees in Selat. HINZLER (1993:444) met in 1990 an artisan from the second caste (born 1935), who had learned the skill from his father.

3.3 Size of inscribed palm leaf and its protection

No particular size was required for palm leaf used by beginners. The social state of a person only had an impact on the choice of material for letters, legal documents and books. *Borassus* leaf could be cut to strips of a length of 6–99 cm and a width of 0.75–5 cm. The broader *Corypha* leaves allowed to obtain a width of at least 6 cm. (SHETH 1996:99, SUBRAMANIAN 1996:172, MARAPATHI 1996:26). In Java and Bali, most *lontar* strips had a length of 25–40 cm and a width of 3.5–4 cm. Texts on the regulation of dams and on cockfight were written on up to 75 cm long strips, magic texts on strips of less than 25 cm (HINZLER 1993:453, 2001:172). The shortest ones of 9–10 cm length were used for accounts, such as the cost for paint and for *suwengs*, 2–2.5 cm wide palm leaf strips for love letters or poems written by young girls who rolled them up to be worn in their ear lobes. Then they were hidden in a garland made for their lovers (HINZLER 1993:464, 2001:169,184). In Dravidian languages, the term *ōlai, ōla* (Table 2) can mean *Borassus* or *Corypha* leaf, palm leaf for writing, "paper" and

Table 2: Common names for palm leaf with script

Name	Language	Meanings	Reference
India			
olei (ōlai)	Tamil	leaf of *Borassus flabellifer*, document, letter, king's orders and messages, Malabarian paper	GRÜNDLER and ZIEGENBALG (new. ed. 1998:298) SUBRAMANIAN*:170
ola (ōla) taliola	Malayalam	*Borassus* or *Corypha* leaf, processed palm-leaf, "tali" from tala	PADMAKUMAR et al. 2003:126
ola	Singhalese	leaf from any palm (also coconut)	RUMPHIUS 1741:48
ole gari	Kannada	palm leaf	GEETHACHARYA*:147
patra	Bengali (Sanskrit)	leaf, page of manuscript	MAHAPATRA*:23
karatalam	Telugu	*Borassus* (dark palm) leaf, common manuscript	SATYAVANI*:126
śritalam		*Corypha* (distinguished palm) leaf	
Indonesia			
lontar, rontal	Old Javanese/ Indian	leaf of *Borassus flabellifer*	cf. Table 1
lontaraq	Buginese, Makassarese	manuscript and Makassar paper	TOL 1999:36
pepesan	Balinese	processed palm leaf	HINZLER 1993:448
lempir		inscribed palm leaf	

* Proceedings of seminar, 1996, ed. HIKOSAKA and SAMUEL.

refer to special uses. In Bengal, *ōlai* is replaced by the Sanskrit term *patra* and in Indonesia by the bilingual name *lontar* (*rontal*). The Balinese of Karangasem have in addition specific names for processed and inscribed palm leaf. The sizes of wax-tablets varied between 40x20 cm and 6x4 cm. Single pages could be fitted together to books (*codices*) and booklets (*codicilli*) with hinges, cords, strips of leather or parchment at the back (BÜLL et al . 1968:789ff.).A bunch of inscribed palm leaf strips held together with a loose string running through a central hole could also become a book. In Indonesia, the most precious type of such a string is made of human hair. If 10–17 of these stringed small palm leaf pages are spread out under each other, text or illustrations look as if they had been arranged on a common large page of a modern book (HINZLER 1993:451, 1999:27)[12].

It seems to be a very ancient oriental custom of protection and preservation to sprinkle dust on a freshly written text. Egyptian scribes used an intense red sand from the western oases, a yellow sand from an island in the gulf of Qulzum and a sand which looked like gold dust (GROHMANN 1957:125). Protection was also attributed to plant powders of particular colour and smell which should either embellish or expell evil spirits. When the Tamil teachers from Tranquebar had finished to incise texts for their palm leaf schoolbooks, they painted the pages with the powdered yellow root of *manschel* (*Curcuma longa,* GRÜNDLER and ZIEGENBALG 1998:135). In Orissa, a powder of dry *neem* leaves (*Azadirachta indica*)[13] was used for the manuscripts (BISOI 1996:55). According to another method, certain herbal materials were placed between the inscribed pages. Leaves of *maragosa* (*Azadirachta indica*), tobacco, *gorbach* (*Acorus calamus*)[14] or red pepper and black cummin, placed in small pieces of cloth, were used in Bengal and elsewhere (MAHAPATRA 1996:27, JOSHI 1996:279). Like in case of the *polyptychons,* the codices, which the Greeks wrote on wax tablets (BÜLL

12 The Buginese of South Sulawesi who produced many manuscripts since the 18th century, developed a peculiar method for reading a *lontaraq* text. They stuck together the narrow inscribed palm leaves and rolled them up like a tape of a modern cassette (TOL 1999:36).

13 The leaves of *Azadirachta indica*, used by the Indians as protection from vermin since a remote past, and the seed oil of this tree contain natural pesticides (cf. JAHN 2004:125–26). Meanwhile, "Neem oil" is also found in modern admixtures for preservation treatments of palm leaf manuscripts in university libraries of Kerala (VIJAYAN 1996:166). Also the root of *Curcuma longa* is known as an ant repellant and germicide (DASTUR 1977:68).

14 Leaves and root of *Acorus calamus*, used traditionally for protection of grain and wool in households and stores, contain efficient insecticides (DASTUR 1977:9).

1968:790, Fig. 567, 628), Indian and Indonesian palm leaf books got also wooden covers and were kept in portable boxes made there – for religious reasons – instead of leather of ironwood, ebony or the yellowish wood of the *intaram* tree (*Azadirachta indica*). The Balinese kept village regulations in bamboo tubes closed with a bamboo lid and a string (HINZLER 1993:456). Other people wrapped palm leaf books in cloth which was tied with a cord. It had to be blue or red in Bengal, because these two colours were believed to repel insects. In other parts of North India the cloth was yellow (MAHAPATRA 1996:27, MURTHY 1996:28).Yellow cloth called *pitawastra* was also used in Java and Bali. Already in the 9th and 10th century, some of these wrapped books were depicted on reliefs of the Hindu temple of Prambanan and the Buddhist temple of Borobudur in Central Java (HINZLER 2001:172–74, 184).

3.4 Writing instruments and adaptation of scripts

In South India, the primary writing instrument for palm leaf is until now a *stylus.* The oldest types of stylus were pointed sticks of wood and bone or a reed, called *qān tuppi* in Accadian, which were used in Mesopotamia for incision of cuneiform script in smooth clay (ANDRÉ-LEICKNAM and ZIEGLER 1982:337–338). The stylus for writing on wax tablets was made of bone, wood, glass, iron, bronze, noble metals and ivory. Its other end was flat or round to erase script and smoothen the wax surface again (BÜLL et al. 1968:854–855). In Tamil Nadu, the iron stylus for writing on palm leaf, mainly leaves of *Borassus flabellifer,* is called *elutukol* (*elutu* = script, *kol* = stick in Tamil). It has also a sharp and a round end. More sophisticated styles are provided with a small knife on one end, to cut the leaves to strips of required length and width. For greater safety, the sharp end and the knife could be sometimes folded towards the opposite side (SUBRAMANIAN 1996:173). The stylus of Kerala, which is also used for writing on *Corypha umbraculifera* leaves, has the same bulbous middle portion like in Sri Lanka (PADMAKUMAR et al. 2003:128, GAUR 1984:50). *Lekhani*, the name for stylus in Orissa (BISOI 1996:49) and other parts of India, is derived from *likhah* = to scratch, to engrave in Sanskrit and can stand for any writing instrument. Wealthy Indians had styles with holders made of gold, silver, brass or copper. Their steel point was sharpened from time to time on an oiled stone (MURTHY 1996:49, 63). The sharp end of the Balinese stylus which resembles a knife, is often protected by a sheath of plaited bamboo. Its name *pangutik* is derived from *kutik* = to move something from right to left or left to right. The prefixed *pa* + *nasal* (*ng*) turn the root into an object (HINZLER 1993:461, Fig. 3,

2004: pers. comm.). To render the incised characters more legible, the palm leaf was besmeared and rubbed with fresh cow dung tinged black and mixtures of oil and charcoal powder, black pigments of coconut shell or crushed, burned candlenuts, *Aleurites moluccana* (BLATTER 1926:194, BISOI 1996:49, HINZLER 1993:462). If the black colour had faded after some time, an incised text could be easily stained again.

In Bengal, where "a stylus is never used", writing on palm leaf was sometimes done with quills from different birds, but usually with an ink- or reed pen called *kalam* (MAHAPATRA 1996:22). This is a term of Greek origin, *kalamos* means reed. The Arabs wrote in pre-Islamic times also with such a *qalam* on a palm material (cf. § 2.4.3). There is evidence that reed pens were already known to the ancient Egyptians (GROHMANN 1967:117), although hieroglyphs on papyrus were written with a brush of soft, chewn bulrush stalks fitted into a holder of reed (BETRÒ 2003:238). Ink-pen and brush also became the writing instruments for the thin and "paper-like" palm leaves, in Indonesia both from *gebang* (*Corypha*) and *Nipah* palm. Precious texts in Sanskrit were written on them. Yet, if the ink was washed away by mishap, the writing was lost forever. This sad consequence is already described in the Javanese Ramayana: "Rama cried, when he got a letter written by his beloved wife Sītā in her beautiful handwriting. When his tears fell on the palm leaf, the letters disappeared (TEH GALLOP 1999:16, HINZLER 1993:460, 2001:168). After improvement of processing, ink pens were in Bengal and elsewhere also used for *Borassus* leaf. The exquisitely illustrated Bengalese manuscripts with the Pala style of painting and dated to the second half of the 10th century and the end of the 12th century, are mostly "palmyra leaf manuscripts" (MAHAPATRA 1996:22)[15]. Carbon ink was made by mixing lampblack or soot with glue or gum (SHETH 1996:100). In Bengal, the ink was occasionally also red (MAHAPATRA 1996:22). For the coloured illustrations on palm leaf, indigenous dyes of mineral and plant origin were used (BISOI 1996:52). The quoted Indian names mean in chemical and botanical terminology: *hingula* = cinnabar, red mercury sulphide, *geru* = red ochre, silicate of aluminia & oxide of iron, *gorachana* = light yellow serpent stone, silicate of magnesia & iron, *haritala* = orpiment, yellow arsenic trisulphide, *kajjala* [kajjali] = black mercury sulphide, *kumkuma* = *Crocus sativus,* saffron, *harida* [Daru ha-

15 HOERNLE (§ 2.3.2) only investigated 14 manuscripts from Bengal. Eight of them, dated to 1386–1721 AD, were written on *Corypha* leaf, the others, dated to 1675–1815, were written on *Borassus* leaf (HOERNLE 1900, Table 1).

ridra] = *Berberis aristata,* (Indian Barberry, Tree turmeric), yellow dye from the root, also a local name of *Curcuma longa* (NADKARNI 1976 vol. 2:20, 72, 95, 97; vol. 1:187, 389 ; DASTUR 1977:33, 67, 68). To obtain blue or green colours, a yellow plant dye such as saffron had to be treated with sulphuric or nitric acid or iron sulphate (DASTUR 1977:68).

The characters of Old Tamil and other Old Dravidian scripts were shaped to fit to easy incision on palm leaf. Since South Indian letters were later also adapted to the writing of Old Javanese and Old Balinese (PIGEAUD 1975:68), they got a similar round shape. *Nagari* (*Devanagari*), the script used for Sanskrit and several North Indian languages, however, had to be modified to *Nandinagari* for writing with stylus. Otherwise, the palm leaf was splitting. In the Nandinagari script of South India, the horizontal top lines are omitted. Also in Orya script on palm leaf, top lines were avoided and letters were rounded up (MURTHY 1996:15). In Maharashtra, a shorthand of Devanagari was used. It was called *Modi*, a term derived from *Mod* which means "to break". *Hemadpant* (1260–1309), the record officer of Ramadev Yadav, had seen the use of *Shikasta* (= to break) script for speedy writing of Persian[16] and thereupon invented a shorthand for the Yadavas. Yet, later also ordinary people wrote private letters and notes in *Marathi* on palm leaf with this Modi script (MURTHY 1996:14, GOPAL 1996:246).

3.5 Speculations on the antiquity of writing on palm leaf

Before the Indians of the pre-Asokan period (4th–5th century BC) made inscriptions on coins, vases or stone, they seem to have developed their alphabets and skills by writing on perishable plant materials such as bamboo chips, bark and wood. In Bengal, wooden "tablets" survived as petty traders' account books while poor people of the North Western provinces had some religious books written with chalk on blackened *phalaka*, as wooden board was called (MURTHY 1996:2, 47–48). In the *Kathaka-jataka,* the early Buddhist literature from the last centuries BC, a "writing material for letters" is called *panna*, which is presumably palm leaf. The quotations refer not only to "writing on *panna* leaf" and "having read the leaf" but also to "sealed it as the merchant would do" (MURTHY 1996:26). *Panna* is obviously derived from *panai* (Tamil) and *pana* (Malayalam), the names of the *Borassus* and *Corypha* palm (Table l). The Tamils also

16 Shorthand was already earlier in use. Notes taken in Greek shorthand on waxed writing tablets in the 3rd century BC are still preserved (GAUR 1984:35, Fig. 15).

still sealed neatly rolled up "olas" (palm leaf letters) with a little gum-lac in modern times (BLATTER 1926:194). The oldest well-preserved palm leaf manuscript, written with ink in Old Kannada, is from the 9th century AD (MURTHY 1996:30). The oldest palm leaf manuscript from Kerala is 500–600 years old (Moser, Department of Indology, Tübingen, pers. comm. 2004). There is no doubt that uses of *Borassus* leaf for clothes, umbrellas, bowls for water and palm sap or other equipment are much older than the use for writing. It is rather likely too that attempts were made to scratch in such food containers similar small signs or symbols for decoration or magic purposes as those found on pottery. It seems to me that the first trials with writing on leaves of the *Borassus* palm could have taken place in the last centuries BC when traders from Hellenistic Egypt, Ionia, ancient Syria and Iraq came to ports of the present Tamil Nadu and Kerala and were welcomed as sons-in-law (*mapilas*) in merchant families (cf. JAHN 2004:105,107). Some of the Indians will have soon learned the languages of their new relatives and friends and how to write small messages and accounts with a stylus on wax tablets. This did not mean, however, that they wanted to take over all foreign practices. Until now it is the custom in rural India to welcome useful inventions or ideas and thereupon to adapt them by local means[17]. *As* the Dravidian society was based on agriculture, matriarchate and a rich cultural heritage, suggestions how to replace bee wax as writing surface by an indigenous material which was also acceptable from a religious point of view,[18] were certainly not made by traders alone but discussed with the women, farmers and craftsmen of their households. The result was the choice of palm leaf. Later, family members of Ionian (Greek) and Semitic origin and artisans from the crew of their ships may have helped the Indians with detailed information on the processing of wax for writing purposes in order to try similiar treatments of palm

17 In North India, incision of script was also tried out on clay like in ancient Mesopotamia. Letters were incised or engraved in round or square tablets ("bricks") of wet clay or mud and then dried or baked. Most finds are from Uttar Pradesh. Tablets from the district Gorakhpur, dated to the 1st century BC, have a Buddhist *sūtra* on them. Early writings on palm leaf could not leave such traces on account of the perishable material. As early as in the 1st century AD, however, copper plates for charters [of local kings] were fashioned like palm leaf strips, i.e. oblong and narrow (MURTHY 1996:29, 44).

18 For Hindus and Buddhists, a material like parchment made from animal hides, is most repulsive. Also the collection of honeycombs from wild bees, which is still only carried out by tribals in South India, is considered as inhumane. Besides traditional beekeeping is not popular in regions of Asia or Africa where sugar is produced from cane or palms.

leaf. Other relatives joined perhaps the efforts to create Dravidian scripts for easy incison on *Borassus* leaf.

Since orthodox Hindus often have an exaggerated sense of "ancientness" (*sanatva*) of their history (WALKER 1968:522), inquisitive Europeans also got misleading information on the first uses of palm leaf for writing. Ferguson reported in 1850 from Ceylon "The oldest Hindoo author who mentions writing on Olas (Palmyra leaves) is *Panniny-rishee*, who lived about the year 790 of the Caliyugam, that is 4,161 years ago, according to Hindoo reckoning" (BLATTER 1926:193). German visitors to the astrological centre in Vaithisvarankoil were told in the end of the 20th century that *Bhrigu*, also called *Vashista* wrote the original texts of their library 5000 years ago in Old Tamil. Copies on fresh palm leaf were then made every 800 years (KRASSA and HABECK 2004:18ff.). European orientalists describe *Vasishta* as one of the legendary "seven rishis" or sages mentioned in the Mahabharata. *Bhrigu* does not belong to them, but became known as a "Brahma-Rishi" at a later date. *Panini* is a famous Sanskrit scholar from the 4th century BC, who was listed among the rishis "for honour's sake" (SCHUMACHER and WOERNER 1994:282, 309). To preserve valuable texts on *Borassus* leaf beyond the lifetime of this perishable material, they were copied again and again on fresh supplies of treated leaves. Kings, Hindu temples and Buddhistic monasteries employed special scribes for this purpose. In rural Karnataka, professional copying scribes called *ōlekāraru'* worked for ordinary people. They moved from place to place with palm leaf scripts loaded on oxen or carts. If people wanted copies, they stayed in their house until the work was finished and asked for food grain as recompensation for their services. Those who could afford it, even ordered a greater number of copies, because the gift of books was considered to be the noblest of gifts (GEETHACHARYA 1996:157).

4 Socio-cultural aspects

4.1 Borassus flabellifer, a sacred tree

In Hindu mythology, God Indra's elephant *Airavati* is said to live in a *tāla* (*Borassus flabellifer*) forest around mount Meru (VIENNOT 1954:76, 277). This tale may indicate that Asian elephants also had a great liking for *Borassus* fruits (§ 2.3.1). More plant lore is told in the poem "Tala vilasam" (§ 2.2). In the countries of the Tamils, "the various productions of earth created by Brahma

came short of men's wants". When Śiva heard the prayers of the humble people, he required from Brahma: "Create the *kalpa tree* upon earth also". Thereupon Brahma created in abundance *tāla* trees (*Borassus flabellifer*) in the three countries Panathar, Panyoor and Panangasdoor (BLATTER 1926:204–205). The celestial *kalpa tree* of the ancient Sanskrit texts is the giant wonder tree providing the drink of immortality for the Gods who dwell in its shade (VIENNOT 1954:81)[19]. Also to Indian Buddhists, *Borassus flabellifer* seems to have been a sacred tree with a distinctive mark, the "auspicious yellow colour" as we can understand from their comparison of the brilliant yellow fruits with the face of Buddha (§ 2.3.2)[20].

4.2 The "holy tools" stylus and pen

The iron stylus for incision on palm leaf is forged by the blacksmiths who have a particular position in many traditional societies. In Bali, the blacksmiths follow ancient Hindu-Balinese laws and believe that their magic power to make weapons and other tools is due to their divine origin from the God of Fire. Therefore they neither want to be grouped with ordinary Sudras like other artisans nor with the Hindu-Javanese who arrived as immigrants to their island. According to the "*lontar*" of their gild, the Brahmins acquired all their wisdom and knowledge of ritual from the blacksmiths, who still have their own "holy water" for forging and religious rites and separate altars in many Balinese temples (GORIS 1984:291ff.). In India, decorations of a stylus consist of carved birds or bulls or painted pictures of a God (SATYAVANI 1996:126). The Indonesian decorations are usually related to the puppet play (wayang) or show a picture of Saraswati, the goddess of wisdom (HINZLER 1993:461). I was not able to find out more about the type of birds depicted in the stylus decorations or the birds providing quills for writing on palm leaf. There are, however, representations of bird messengers for palm leaf letters on narrative reliefs on the Pendopo terrace of the

19 The *kalpa* tree has been compared by other authors to the mango (*Mangifera indidica* L.), the jambu or rose apple tree (*Eugenia jambolana* Lam.) and to two species of *Ficus* (VIENNOT 1954:81).

20 Although *Corypha umbraculifera* is not mentioned in the detailed monograph on Ancient Indian tree cults by VIENNOT (1954), it is not unlikely that also the seldom sight of its giant inflorescence (§ 2.1) was understood by other Buddhists as a "divine mark". Since a Chinese pilgrim saw in the 7th century AD in South India a stupa surrounded by a palm forest, it was supposed that Buddhist monasteries maintained nearby palm plantations for their book production because the ancient Egyptians had also set up papyrus plantations around Alexandria (GAUR 1979:12).

Panataran temple complex in South-East Java dated to 1375 AD, which were identified as "green parrot" and as *Cacatua sulphurea*, a yellow-crested cockatoo, indigenous to Lombok and Sulawesi. The men and young women who face these birds in the reliefs are holding a lontar leaf in their hand or watch a flying bird with a palm leaf letter in the beak. Parrots or cockatoos are still regarded as "postilion d'amour" in the oral folk tradition of Java and Bali (HINZLER 2001:180–84). In Hindu iconography, the parrot is the vehicle on which Kama, the God of Love, is riding (DOWSON 1992:146). The yellow crested cockatoo, on the other hand, has similarities with the hoopoe of the Nile valley. *Upupa epops* L. was already in Ancient Egypt a sacred bird of great wisdom on account of its sun emblem, the radiant crest, as we know from the "Papyri graecae magicae" (300 AD). Its Greek name *epops* (*'επoψ*) is probably derived from *apopis* (*'αποπις*), an ancient Egyptian sun-name. Also in the folktales of the Arabs, the bird was related to religions. The "hoopoe of the South" belonged to the sun sanctuary of Saba. The *hudhud* (hoopoe) of king Salomo, an early prophet of Allah, was venerated as a mighty king of birds who guided and protected Salomo during his travels. Later it also transferred love letters between Salomo and Bilqis, the Queen of Saba (JAHN 1981:387–388). In rural areas of African Islamic countries, beak, blood and heart of the hoopoe are involved in many magic uses of writing[21].

4.3 Greek and Indian divine teachers for writing

On an attic vase from about 480 BC (now in Munich), the *Triptolemos painter* depicted the Greek goddess *Athena* with helmet, shield, stylus and wax tablets (Fig. 4). The backside of the vase shows an infibulated ephebe with a spear. A replica of this amphora (now in Paris) was attributed to the *Oinokles painter* who depicts at the backside a bearded man. Art historians had different ideas what the goddess is writing in the presence of these two men. Poland-Reisinger-Wagner (1925) only wrote that *Athena's* gesture with the raised stylus in her right hand means, that an idea just came to her mind or she wonders what to write in the

21 During the last decades of the 20th century some Fekkis (teachers of Koran) of the Mahas-Nubians (Geror district, Northern Sudan) still wrote amulets to arouse popularity or love with blood from the hoopoe as ink, while Tunisians from Nefta used for the same purpose a pen made from a hoopoe's beak. There were also still students from the Hamar tribe (Khouwei area, Kordofan) who wanted to memorize at best before university examinations, and therefore swallowed the heart of a *fekki witiwiti* (hoopoe) on which the *ayat al fahim* (verses "for" understanding, a modified quotation from the Koran) had been written (JAHN 1981:379, 382–83).

triptychon (LULLIES 1956:25–26). According to GERHARD (1831), *Athena* enrolls a young man for war service (DORNSEIFF 1925:9), while WÜNSCHE and KNAUSS (2004:291) maintain, that she records a successful Olympic pentathlon in her list of winners. The bearded man was identified by Lénormant and de Witte (1844) as the cultural heroe *Palamedes* to whom *Athena,* the "inventress of letters", teaches the art of writing[22]. Similar stories on the origin of writing in ancient Greece are found in the Scholium in Dionysios Thrac. dated to the 7th century AD (DORNSEIFF 1925:8–9).

The teachers of Tranquebar performed a rite for *Wináiagen* (*vināyakaṉ* = *Ganesha*), the god of wisdom and learning, after they had finished to write the schoolbooks on palm leaf for the beginners (GRÜNDLER and ZIEGENBALG 1998:134, 310). In Kerala and Northern India, where the concern for Sanskrit studies is greater, *Sarasvati* enjoys the main veneration as Hindu deity of arts and learning. Originally she was a river goddess (*wati* = river). In a sculpture from Mathura from the 1st century AD, now in the Lucknow Museum, she is already shown as *pustakapāni*, i.e. having a book in one of her four hands (MURTHY 1996:11). Later she became known as the inventress of *Sanskrit* and the *Devanagari* letters (DOWSON 1992:284). During the *Vasanta Panchami* festival in January/February, Bengalese children and students take out clay figurines of *Saraswati* in procession and ultimately immerse them in the Ganga or any other nearby river or tank (SHARMA 1978:58). In Bali, where a festival for *Sarasvati* takes place at her name day in the week *Watugunung,* Hindu children and students go to the *Pura Jagat Natha* temple in Denpasar to pray for success in their studies (EISEMAN 1994:184). *Saraswati* is also the guardian deity of the *lontars* which are taken out at the same day, exhibited in a pavilion and cleansed. A priest then performs the *Puja Saraswati* offering and sprinkles the *lontars* with holy water (HINZLER 1993:457). In the iconography of the Buddhists, *Prajñāpāramitā,* a female Boddhisattva blessed with "transcendent wisdom", is depicted like *Sarasvati* with a book in one of her four arms. This

22 Precursors of *Palamedes* and *Athena* are in the religion of the ancient Egyptians *Thoth* and the goddess *Seshat*, who was also venerated as "Mistress of the house of books". Her name seems to be derived from the Egyptian term for scribe (ANDRÉ-LEICKNAM and ZIEGLER 1982:342).

"book" can be an Indian palm leaf manuscript or a Tibetan block book (SCHUMANN 1993:156)[23].

4.4 Palm leaf for teaching school children

For the ancient Greeks, a "school" was in the beginning a privilege of the upper classes. Their word *σχολή* means "leisure" and "activities for leisure time". A red-figure drinking cup (diameter = 28.5 cm), found in an Etruscan necropole at Cerveteri (1872), conveys a vivid idea about private lessons in a wealthy family. The potter and painter *Douris* who signed this cup, lived between 500 and 470 BC in Athens. The outside of the bowl shows a beardless teacher who sits on a chair and corrects with a stylus what a youth, who stands in front of him, has written on a wax tablet. Papyrus roll and wax tablet are also hanging at the wall. A dignified elder teacher, who instructs another young man in declamation, has opened a papyrus roll on which the beginning of a heroic epic is written. This indicates that wax tablets were only used by beginners and for preliminary drafts (GREIFENHAGEN 1962:29–30, plate 77, BÜLL et al.1968:823, KNITTLMAYER and HEILMEYR 1998:80–81 with plate). The oldest preserved wax tablets from schools, dated to the 3rd century BC, are from Abusir near Alexandria and Tadmor (Palmyra). They show as exercise copies of verses by Greek poets and the teacher also wrote remarks on the performance of the student (BÜLL et al.1968:868, 869 and Figs.)[24].

Some Indian children were probably already taught the art of writing during the last centuries BC. The cheap leaves of a multipurpose palm tree also allowed men and women from the low classes to become literate. In Madhya Pradesh, a sculpture at one of the Hindu temples of *Khajuraho* (10th–11th century) depicts a woman who writes with a stylus on palm leaf. MURTHY (1996: legend to plate 40) thought that she is writing a letter. Since a small girl, who is looking up to her, stands in front of her (Fig. 5), she might represent a teacher. In Tranquebar,

23 Reliefs on the Buddhist temple of Borobudur (§ 3.3) depict nuns reading or chanting a holy text written on palm leaf and a group of female disciples with a woman teaching a text from a lontar palm manuscript (HINZLER 2001:178).

24 Before school children in Ancient Egypt were allowed to write on papyrus, they practised writing on wooden tablets covered with a layer of stucco (ANDRÉ-LEICKNAM and ZIEGLER 1982:347). All other wax tablets found in Egypt in the oasis of Fayum and elsewhere, are only covered with Greek, some also with Latin script. The use of wax tablets survived at least to the 19th century. The overseer of the fish market in Rouen (France) still used them for sale by action in 1849 (BÜLL et al.1968:786, 796, Fig. 619).

Fig. 4: The goddess Athena with her stylus and wax tablet "note book" (Triptychon) painted on an attic vase about 480 BC (Source: BÜLL et al. 1968:822).

Fig. 5: Indian woman writing on palm leaf, sculpture from a temple in Khajuraho, 10th–11th century (Source: MURTHY 1996, plate 40).

palm leaf was considered to be far too precious to be spoiled by the first clumsy trials with incision of script. We know from a "letter" composed by a Tamil teacher in the 18th century, that each child entering school had at first to practise thoroughly with a stick on sand to write numerals, Tamil characters and even a few words (JAHN 2004:114, 126). At present, professional scribes, working for temples or individual patrons to copy palm leaf manuscripts, are gradually vanishing. Besides, the Western type of education gives more hope for employment (SAMUEL 1996:195). In many places of South India, however, small Hindu chil-

dren still have to write in the beginning on palm leaf. The foresters from Kerala (PADMAKUMAR et al. 2003:129, Fig. 7) recently presented in their article a photograph showing how a small boy and two girls from a pre-primary school are taught by an elder traditional scribe to write their first alphabet on palm leaf. In Bali, the circumstances are more complicated. School children now hardly know to read and write Balinese, because the official language for elementary education is Indonesian (HINZLER 1993:466).

4.5 Peculiar categories of palm leaf books

4.5.1 Technical literature by craftsmen and healers

With the dissemination of *Borassus* leaf as an inexpensive writing material, low-caste craftsmen could write books of great practical interest in their mother tongue, while scholars had before only briefly mentioned their work and used Sanskrit terms. The technical "handbooks" of these craftsmen deal in detail with raw materials, manufacture, technologies and special methods which should remain a family secret. For the gilds, they recorded law, lore and rules for ceremonies. Such texts hold a significant place among the preserved palm leaf manuscripts of Tamil Nadu (SUBRAMANIAN 1996:175). Indonesian craftsmen followed this example as already mentioned with respect to the Balinese blacksmiths (§ 4.2). *Lontars* of the carpenters and architects describe the offerings for a living tree before it can be "sacrificed" for timber, and specify items such as the wood for different types of buildings, furniture, masks and tools, the size of compounds assigned for each caste or auspicious directions (EISEMAN 1995:190–195). Other *lontars,* mainly written in Old Javanese, advice on the keeping of horses and doves (HINZLER 1993:442) or the breeding of cocks for fight. Balinese *lontars* provide classifications with respect to colour, shape and other characteristics of the cocks which have an impact on fights at certain days or phases of the moon and also deal with the angle at which a tiny razor-sharp dagger (*taji*) has to be fixed to the left leg of the bird (EISEMAN 1995:242ff.). Descriptions of useful plants are found in palm leaf books of traditional healers. In the 17th century, for example, the Dutch got valuable data on uses and vernacular names of local plants for their "Hortus Malabaricus" from a famous village healer who had a family handbook written with a *kol* (stylus) in *kolezutu*, a modified version of a Tamil/Malayalam script used to about 600 AD (MANILAL 1980:114). Balinese medical *lontars* called *usadas* also deal with plants. Usada is derived from *osadhi* which means medicinal herb in Sanskrit. Small *lontars* with the most common traditional recipies were found in almost every family in

Bali. Healers specialized in diseases, treatments and healthcare kept also family handbooks to preserve the experience of generations like the craftsmen. Some of them had also studied original or translated texts on classic Indian medicine and then used many terms in Sanskrit and *Kawi* (Old Javanese) in their *lontars.* The author of the "Taru premana", a kind of Balinese pharmacopeia, used in addition an unusual style. All cited plants are introduced as "persons" who speak about their special properties and the diseases they are able to cure (WECK 1986:6, 11, 223).

4.5.2 Religious and historical texts affected by syncretism

In South India, writing on the leaves of a cherished local palm also strengthened the efforts to keep national and religious identity and independence. We know from the "palm leaf letters" written by teachers in Tranquebar by request of the missionaries GRÜNDLER and ZIEGENBALG in the 18th century (1998, ed. LIEBAU:61, 63,285,302), that many Tamils of Tanjore became Hindus without to accept to be taught and ruled by a Brahmin elite of North Indian Aryans. Most of their priests did not know Sanskrit and much of the pre-Hindu religion survived in their "Śaivism". They even called their highest god *Ruddiren* [*ruttiraṉ*], because *Rudra* had amalgamated with Śiva. The creator god Brahma (*Birúma* [*piramā*]) was subordinate to him. Rites for non-Aryan deities were also popular in Bengalese villages. The worship for *Dharma,* who was venerated as an ancient folk deity and a sage, had also vēdic and purānic elements. Different poets and a folksinger embroidered the episodes in two poems about him. The texts were recorded on 52 and 94 folios of palm leaf (now in the manuscript collection of a Bengalese university). Also poor literate people from Western Bengal prepared already in the 16th century their own copies of the fable on "cheap palm leaf" because paper was too costly for them[25] (MAHAPATRA 1996:32, DOWSON 1992:88).

In the pre-Islamic period, many Sanskrit texts were translated in Java. At courts, Old Javanese became the exclusive written language. Also after Islam had become the official religion, palm leaf texts related to Śaivism or Buddhism were in remote mountain districts written with a special *buda* (Buddhist) or *gunung* (mountain) script. The first Muslims who came to Java, were traders from India

25 Since the 11th century, paper from China was imported to Bengal. In Western India, it was imported from the Middle East and Persia. Jain scholars already abandoned palm leaf in favour of paper since the 12th century (MAHAPATRA 1996:32, SHETH 1996:97).

and South East Asia who had been brought up in Shiah traditions. *Lontars* dealing with the conversion of Java, attribute it to nine *walis* or Muslim saints who had arrived at the Northern coast (PIGEAUD 1975:77–80). In the 15th century, the new faith was also introduced to Lombok, an island which had been like Bali a dependency of the Indo-Javanese kingdom Majapahit. For the sake of the close cultural links between Eastern Java and Lombok, writing on palm leaf was imported from Java and Sasak literature was at first written with Javanese letters. Thus Sasak *lontars* contain legendary religious and historical literature with a blend of mystical Javanese Islam, Hinduism and indigenous animistic beliefs. In Lombok the prophet Muhammad, for example, was best known by the name *Kertanah* as he was called in childhood. The word is said to derive from *kerto ing tanah* = he who brings the law to the world. Early indications of his fitness to become the apostle of God were, that he became the leader of 44 playmates, a cucumber stick which he had played with, grew into a date palm etc. Much loved was also the romance of a son of the Muslim heroe Amir Hamzah with princess Dewi Rengganis, who had got mystical powers like a butterfly because she only lived on the nectar of flowers (MARRISON 1999:6, 53, 85). The cult of local Muslim saints is also known in Bali. According to a legend, *Haji Çaka,* a gracious [Muslim] prince from Java, had brought *huruf* (letters) for the Balinese language from the country of the Indians and taught them to his disciples. His collaborator *Bathari Sarasvati,* the goddess (Lady) of speech, had created their mystical "sound" believed to be localized in the tongue. A particular *lontar* of the Balinese healers called *Usadha Selam* (Islam) explains how to cure diseases with verses from the Koran in combination with ancient Balinese mantras (WECK 1986:6, 68).

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