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INTRODUCTION TO BASIC WOOD IDENTIFICATION

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Introduction

Identification of wood is the process of examining the anatomical features of wood specimen to determine its species. It is a necessary requirement to know the exact species name in trade, customs and exise, construction and scientific research so as to avoid dispute in pricing, taxation, strength performance and biological characteristics respectively. There are several methods used in the identification of wood. For wood which consist of very distinct features like kempas, merbau, bintangor and nyatoh observation on the cross section of the wood using a hand lens of 10x magnification is sufficient. However, for timber groups which do not have distinct features, it is necessary to make observation on their minute features through the use of microscope. With the introduction of scanning electron microscope (SEM) more detailed structure of wood can be observed. But the use of SEM is more for academic purpose, and it is seldom used for general wood identification work. FRIM's Wood Anatomy Laboratory (WAL) has been providing identification service to the timber industry, government agencies and building constractors to ensure that the right type of timbers are used for their works. This paper describes some important features of hardwood that are useful when carrying out wood identification works using only a hand lens of 10x magnification.

Anatomical features of hardwoods

Hardwood is made up of several anatomical elements. The principal anatomical elements are 1) vessels or pores, 2) parenchyma, 3) rays, 4) fibres (Wheeler et al. 1989). However, among these four principal elements only vessels or pores, parenchyma and rays are important in hardwood identification (Figure 1).

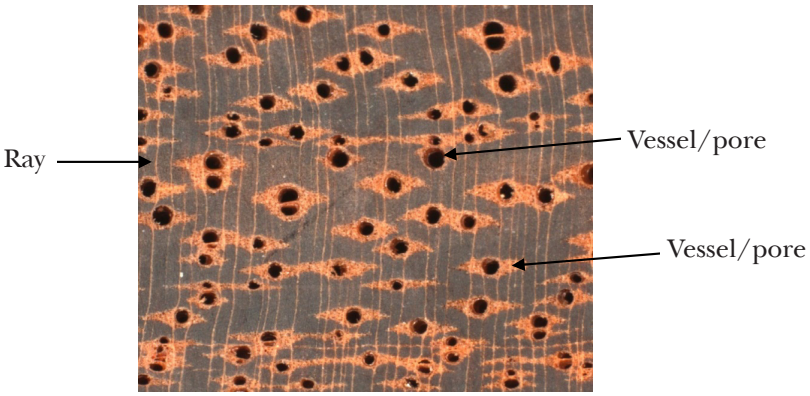


Figure 1 Principal structural elements that are important when examining the wood

Examination of wood using a magnifier

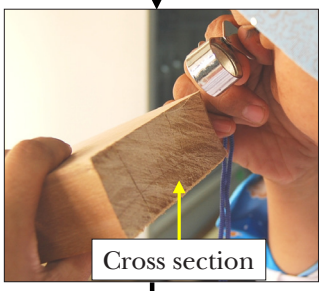
Before a piece of wood is examined, a sharp pocket knife is used to prepare a clear and smooth cross section so that the anatomical features can readily be seen with the naked eye or with a hand lens. The most commonly used hand lens for identification is the folding type. Normally a 10x magnification is sufficient for examining the anatomical features. The lens should always be held as near to the eyes as possible and adjust the specimen until it is in focus. By doing so, a clear and magnified field of view will be obtained. Care should be taken to get good light source on the surface under examination. Both eyes should be kept open whilst using the lens (Ani & Lim 1993). For hardwood identification, the observation is done on the principal structural elements which are:

1) vessels or pores,
2) parenchyma
3) rays

The details of the structure are elaborated as follows. The first point to note for wood identification is the presence or absence of vessels to determine whether the specimen is a hardwood or softwood respectively. Next is the examination of the type and distribution of parenchyma, width and visibility of the rays, the presence or absence of vertical and horizontal canals. Succeeding that, observation on two anatomical features i.e. included phloem and latex traces are done. To establish accurate identification using these steps requires comparison with contemporary collections of reference specimens or the use of publications containing description and images. Dichotomous keys are also used whereby step by step analytical procedure on the examination of the wood anatomical features is followed.

Steps for wood identification

A sharp knife and a 10x magnification lens are used for wood identification



The lens should always be held as near to the eyes as possible and the specimen is brought up until in focus. The observation on the wood should be done on the cross sectional surface

Observation on vessels to determine whether the wood is softwood or hardwood (softwoods are without vessels)

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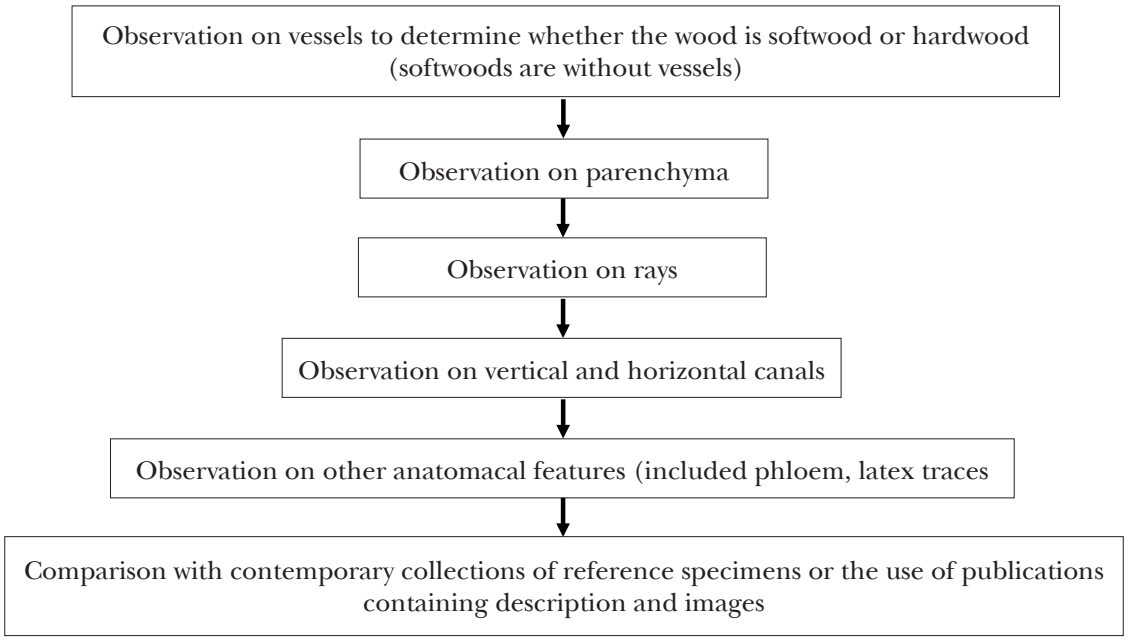

Vessels or pores

Vessels or pores on the cross section surface of wood are seen as small, round or oval holes. They function as the sap-conducting system for a tree. The important characteristics of vessels or pores that are useful in wood identification are types of vessel, vessel arrangement, size, density and contents (Ani & Lim 1993). Most of the Malaysian woods have vessels of fairly uniform size and distributed evenly throughout, and they are known as diffused porous woods (Figure 2a). However, there are a few types of wood with distinctly large vessels in the early part of growth known as ring porous (Figure 2b). Vessels are arranged as solitary (Figure 3a), pairs of two, radial multiples (Figure 3b) or in oblique pattern (Figure 3c). In addition, vessel size and density are also important features used in identification, for example, large but few numbers of vessels in durian (Figure 4a) and small and numerous vessels in chengal (Figure 4b). Other features of vessels that have some value in identification are vessel deposits (Figure 5a) and tyloses (Figure 5b).

Vessels

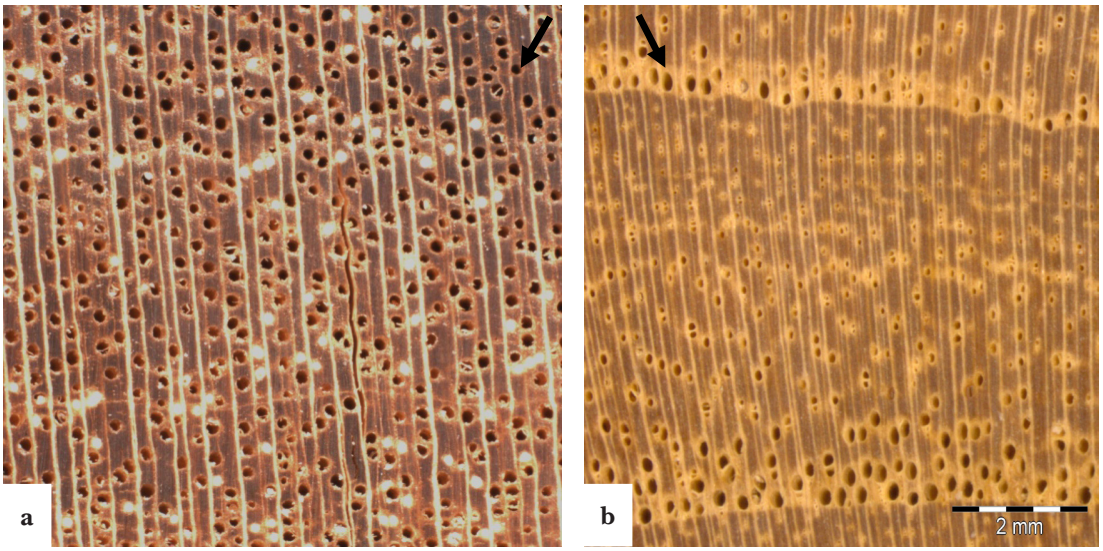

Figure 2 (a) Diffused porous of vessels in resak (*Vatica* spp.) (b) Ring porous of vessels in sungkai (*Peronema canescens*)

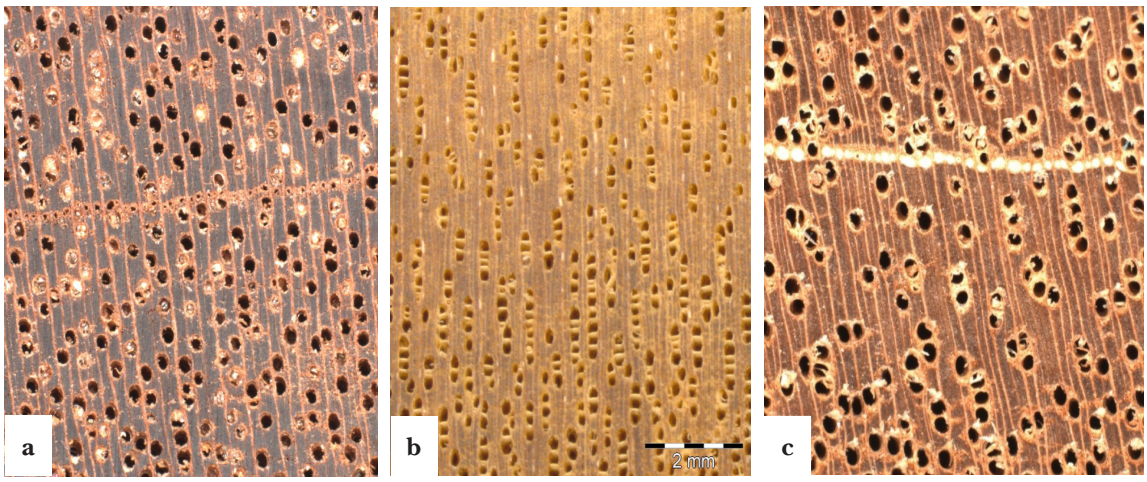

Figure 3 (a) Solitary vessels in kapur (*Dryobalanops* spp.), (b) Multiple arrangement of vessels in kulim (*Sandoricum* spp.) (c) Vessels in oblique pattern in white meranti (*Shorea* spp.)

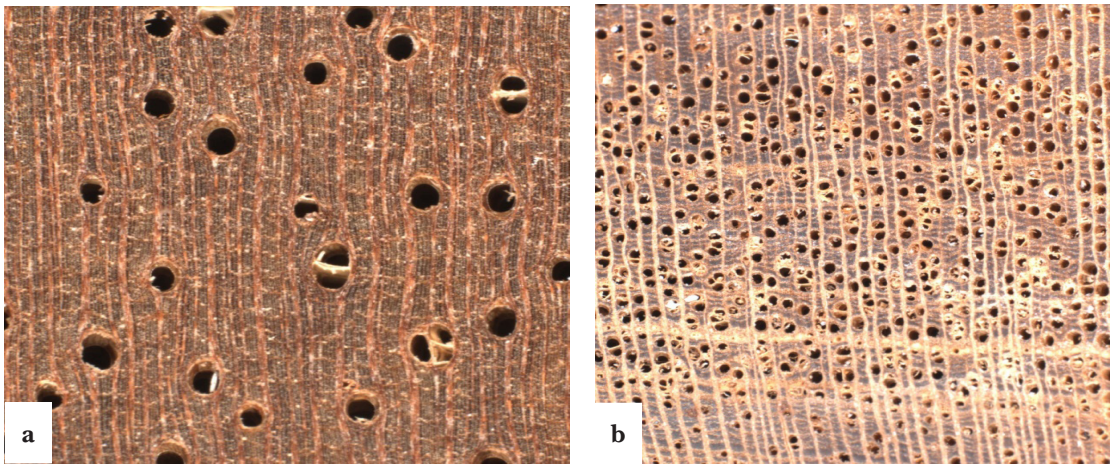

Figure 4 (a) Large but few numbers of vessels in durian (*Durio* spp.) (b) Small but numerous vessels in chengal (*Neobalanocarpus heimii*)

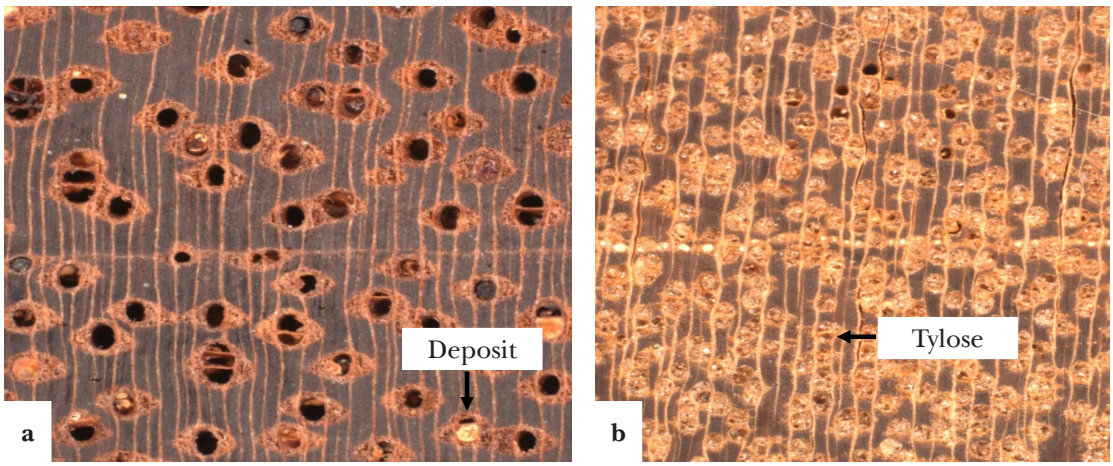

Figure 5 (a) Deposits in merbau (*Intsia* spp.) (b) Tyloses in balau (*Shorea* spp.)

Parenchyma

The parenchyma tissue functions as storage and distribution of reserve food materials. In hardwoods, wood parenchyma varies in amount from very little or none to very abundant. The amount and arrangement of the tissue provide an invaluable aid to identification (Ani & Lim 1993). Some important wood parenchyma arrangements that are used in wood identification include the apotracheal parenchyma, diffused parenchyma as in mersawa (Figure 6a), extend from ray to ray as in chengal (Figure 6b), regularly spaced bands as in nyatoh (Figure 7a) and irregularly spaced bands as in machang (Figure 7b). For paratracheal type of parenchyma, it may be in the form of confluent as in tualang (Figure 8a), aliform as in ramin (Figures 8b) and vasicentric as in kungkur (Figures 9a). In addition to the above, some timbers may not contain parenchyma cells that are easily observed, even with a hand lens, as in kedondong, and this can be used as a possible clue for identification (Figure 9b).

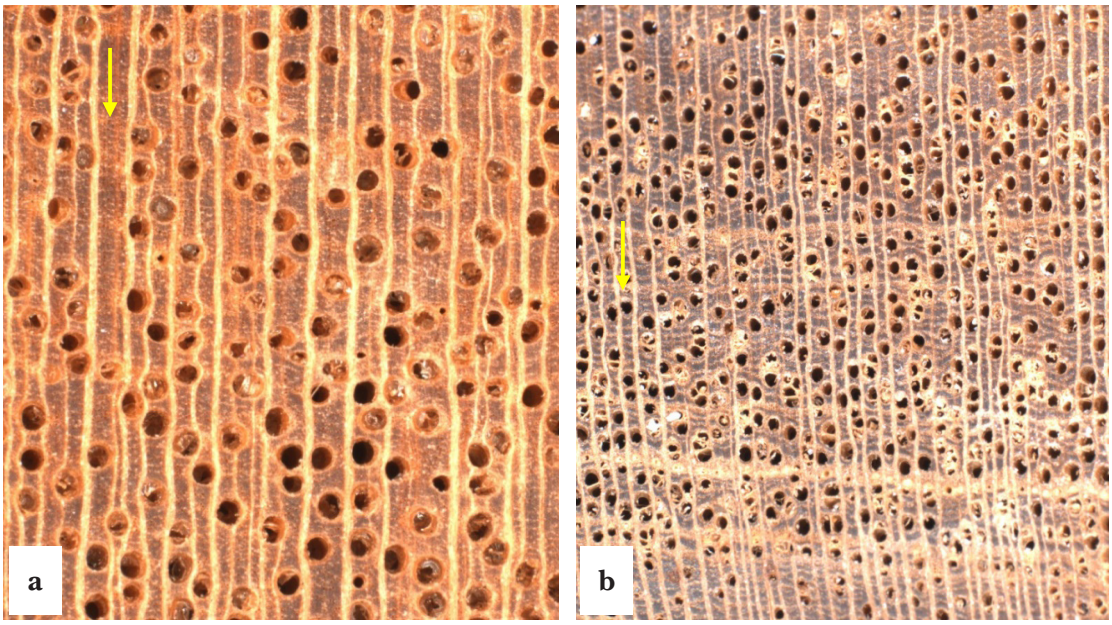

Figure 6 (a) Diffuse parenchyma in mersawa (*Anisoptera* spp.) (b) parenchyma extend from ray to ray in chengal (*Neobalanocarpus heimii*)

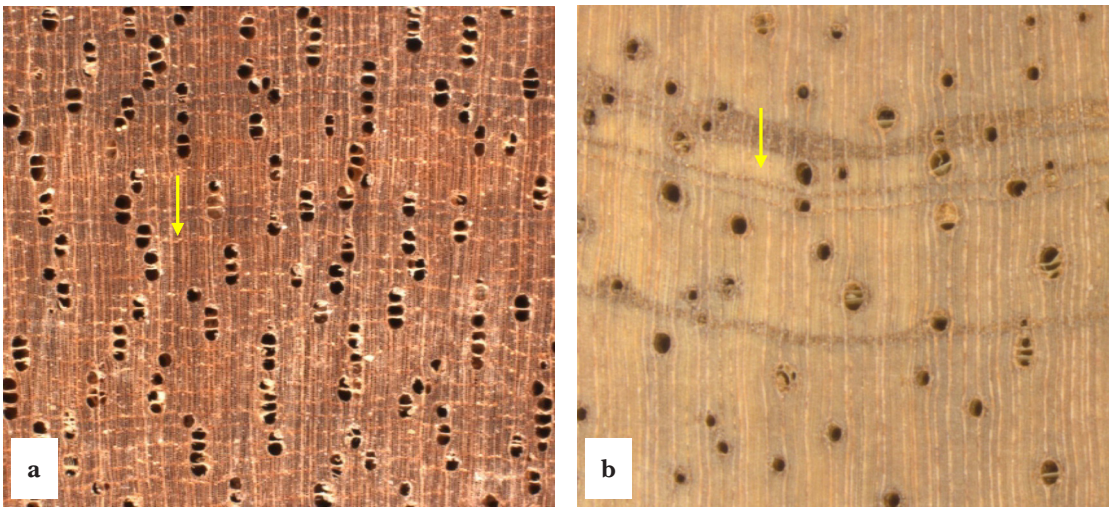

Figure 7 (a) Regularly spaced bands in nyatoh (*Palaquium* spp.) (b) irregularly spaced bands in machang (*Mangifera* sp.)

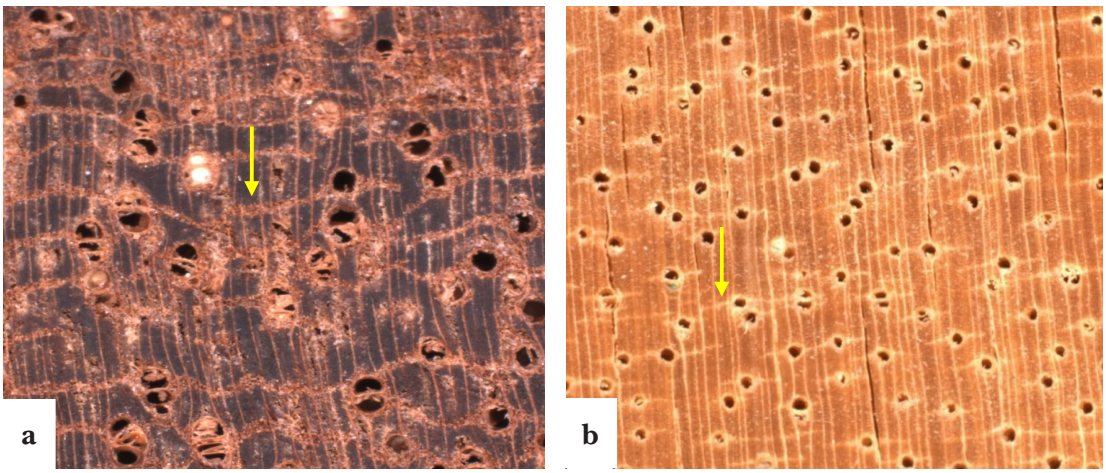

Figure 8 (a) Confluent parenchyma in tualang (*Koompassia excelsa*) (b) Aliform parenchyma as narrow wings in ramin (*Gonystylus* spp.)

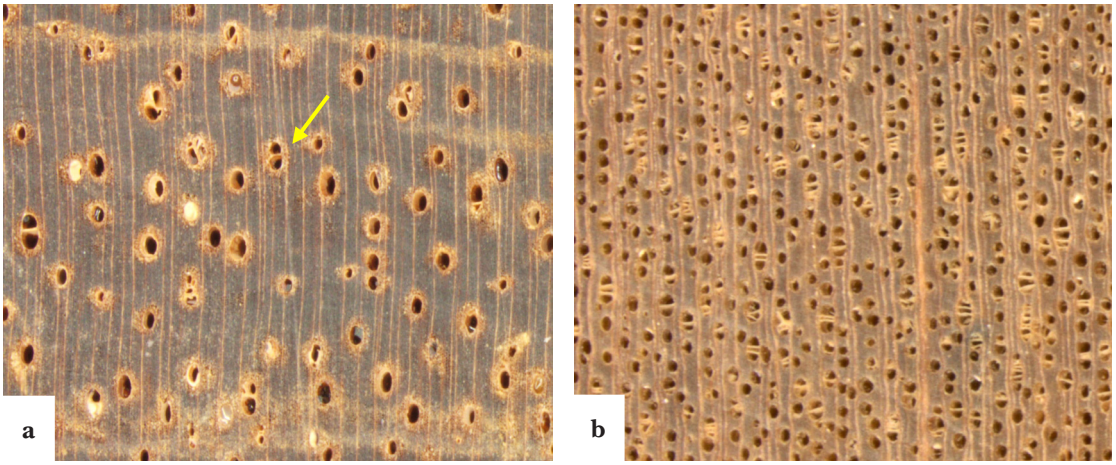

Figure 9 (a) Vasicentric parenchyma in kungkur (*Albizia splendens*) (b) parenchyma not visible with hand lens in kedondong (*Dacryodes rostrata*)

Rays

The width of the rays as seen on the cross section may vary considerably in different woods and can be a valuable feature in wood identification. Some woods such as resak, keruing, mersawa and kembang semangkuk contain two distinct sizes of rays (Figure 10) where narrow rays are interspersed between each set of broad rays. On the other hand, some woods have broad rays like mempisang whereby the broad rays (Figure 11a) may give rise to a distinctive figure on the longitudinal radial surface. Rays also can be narrow and very fine rays as in berangan (Figure 11b) (Ani & Lim 1993). Some woods such as terap and keledang have distinct orange-brown rays. Some of the woods have features known as 'ripple marks' due to the storeying of the rays (Figure 11c). Ripple marks resemble the undulating surface of the sea beach soon after the tide has receded. Woods such as keranji, chengal and melunak have very distinct features of ripple mark.

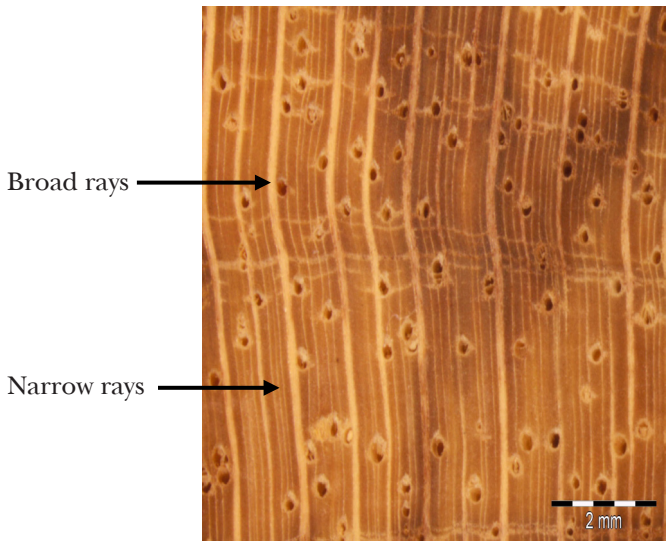

Figure 10 Rays with two distinct sizes in kembang semangkuk (*Scaphium macropodum*)

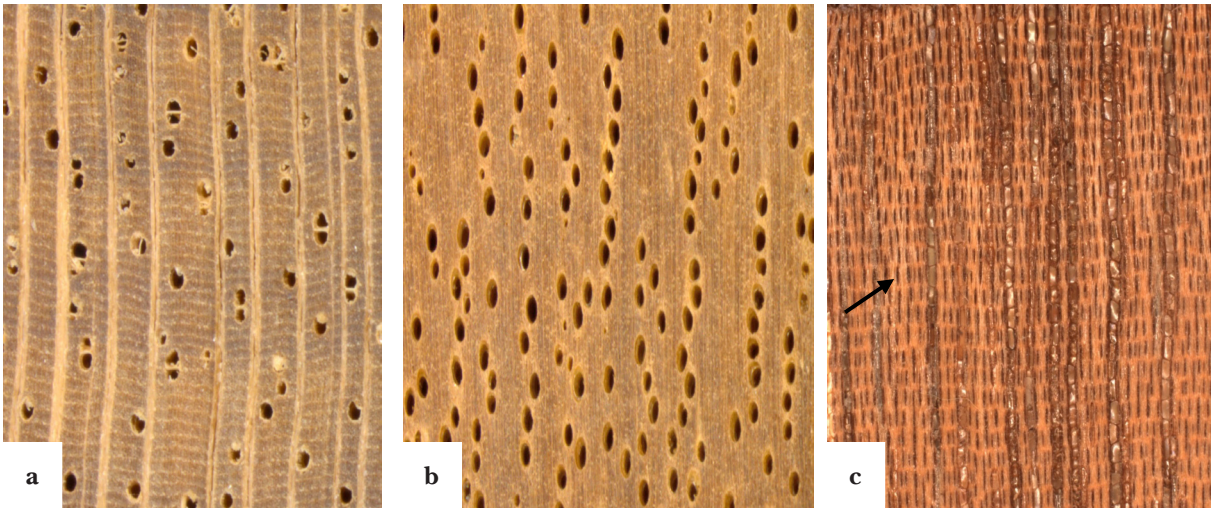

Figure 11 (a) Broad rays in mempisang (*Mizettia* spp.) (b) Narrow rays in berangan (*Castanopsis* spp.) (c) Ripple mark in Melunak (*Pentace* spp.)

Other structural features

Other structural features such as included phloem and intercellular canal could be diagnostic features to wood identification (Menon 1971). Included phloem happens when the phloem or bark tissue gets enclosed in wood (Figure 12a). It is found in timbers like kempas and tualang. Intercellular canal is made up of long and narrow passages, lined with a special type of parenchyma cells which secrete resin in chengal or oil in sepetir (Ani & Lim 1993). Intercellular canals can be in the form of vertical canals if they extend parallel to the axis of the tree as in balau and chengal. They are known as horizontal or radial canals if they extend across the grain in a radial direction as in terentang (12b). There are two types of vertical canals: normal canals and traumatic canals. The normal canals may secrete resin as in chengal, balau and dark red meranti, and they are known as resin canals. In sepetir the normal canals secrete oil, and they are known as oil canals. The normal canals may occur diffused as in resak (Figure 13a), in short tangential series as in keruing (Figure 13b) and in continuous concentric formation as in balau (Figure 13c). On the other hand, the traumatic canals usually occur sporadically as a result of injury in concentric formation and are generally as large as the vessel diameter (Figure 14a). Latex traces are characteristic of a few species of wood such as jelutong and pulai (Figure 14b).

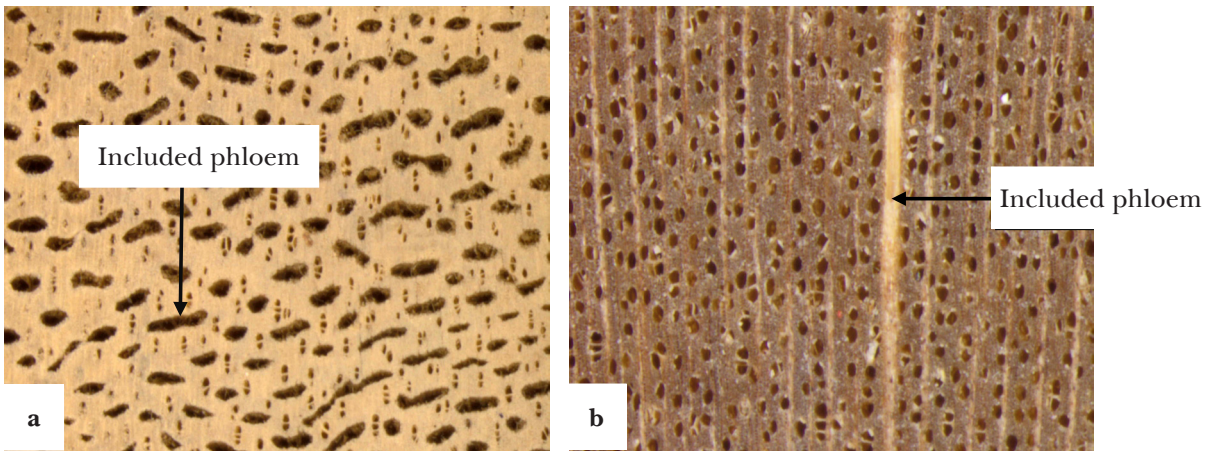

Figure 12 (a) Included phloem in karas (*Aquilaria* spp.) (b) horizontal canal in terentang (*Campnosperma* spp.)

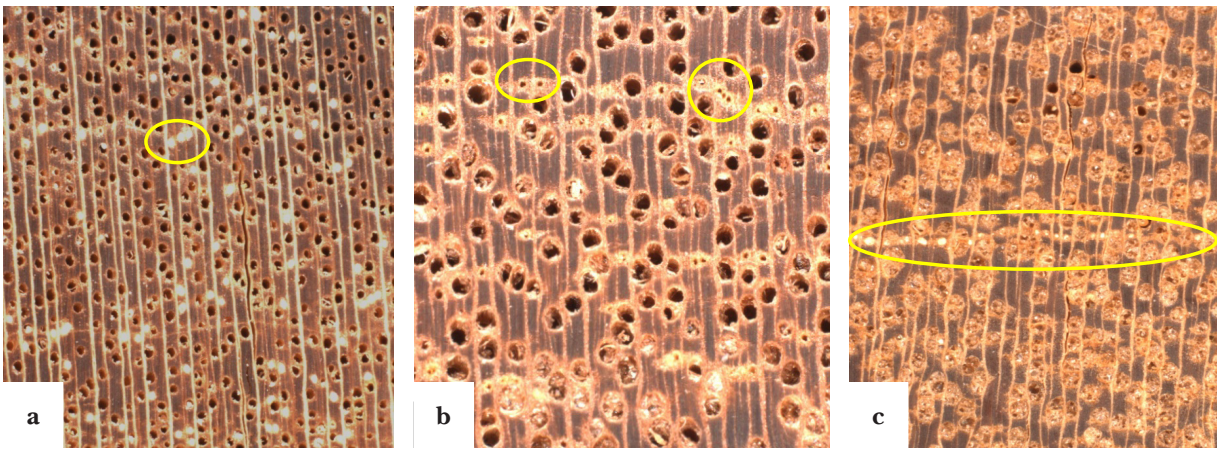

Figure 13 (a) Vertical canals diffuse (circle) in resak (*Vatica* spp.) (b) Vertical canals in short tangential series in keruing (*Dipterocarpus* spp.) (c) Vertical canals in concentric formation (circle) in balau (*Shorea* spp.)

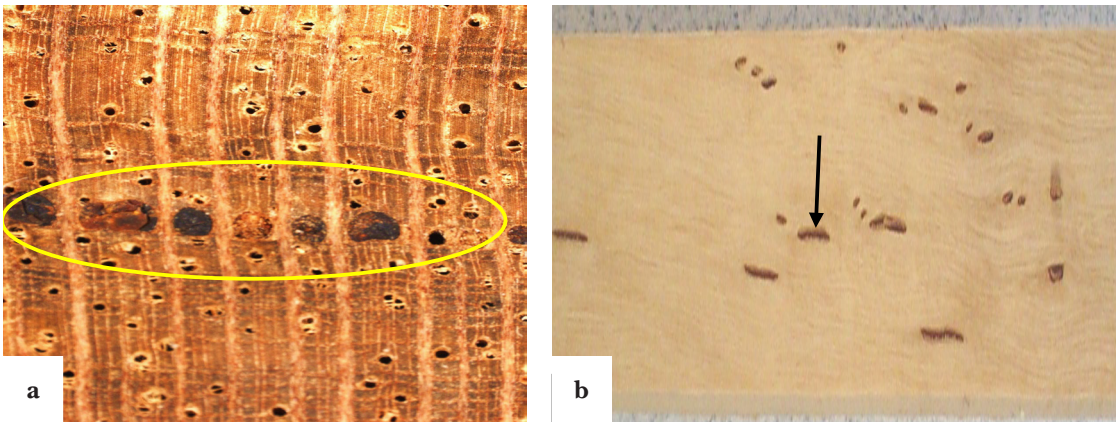

Figure 14 (a) Traumatic canals in kembang semangkok (*Scaphium* spp.) (b) Latex traces in jelutong (*Dyera* spp.)

Conclusions

This paper entails to the rudiments of wood identification techniques appropriate for anyone with early interest in this field. Nevertheless, since there are multitudes of wood species in the forests the accurate wood identification should be left to professional timber graders or

anatomists if the identification is needed for trade, legal, research or academic purposes. To provide an easy tool for wood identification, FRIM had developed a website: http://info.frim.gov.my/woodid/Identification.cfm for the public to freely use. It is an intuitive and user-friendly website for anyone with interest in timber identification to easily identify wood based on its anatomical features.

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