FIRST RECORDS OF LAURELWOOD *CALOPHYLLUM* SP. (MALPIGHIALES: CALOPHYLLACEAE) DRIFT ENDOCARPS FROM IRISH MARITIME SHORES AND A REVIEW OF NW EUROPEAN AND WESTERN ATLANTIC RECORDS

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Abstract

The first three confirmed records of Laurelwood *Calophyllum* drift endocarps stranded on Irish maritime shores are reported. A previous specimen dating from the early 1900s, collected on the Isle of Barra, NW Scotland represents the first known record from NW Europe. *Calophyllum* drift endocarps are considered to be true peregrine disseminules originating from the Caribbean and/or tropical Western Atlantic.

Key words: Laurelwood, *Calophyllum*, drift endocarp, standings on Irish and NW European maritime shores.

Introduction

The Family Calophyllaceae includes about 12 genera and approximately 437 species occurring in tropical regions of either the Old or New World. *Calophyllum* is the largest genus, represented by about 190 species mostly found in the Old World ranging from eastern Africa to the Pacific. Only about 10 species and/or varieties of *Calophyllum* are currently known to occur in the New World, generally ranging from Mexico and the Caribbean Islands southwards to Argentina in South America (Stevens, 1980a; Vela Diaz, 2013).

At least five species and three varieties of *Calophyllum* are known to occur in hydrometric catchments draining into the Caribbean and/or tropical Western Atlantic: *C. brasiliense* Cambess., including three varieties (*C. brasiliense* var. *brasiliense*, *C. brasiliense* var. *antillanum* (Britton) Standl., and *C. brasiliense* var. *rekoi* (Standl.), *C. inophyllum* L., *C. longifolium* Willd., *C. mesoamericanum* Vela Diaz, and *C. pachyphyllum* Planch. & Triana (Funk *et al*., 2007; Vela Diaz, 2013; Anon., 2022).

Calophyllum angulare A.C.Sm., which is primarily confined to seasonally dry tropical biomes in the Mato Grosso region of central Brazil, and *C. pubescens* Vela Diaz, which is confined to wet tropical biomes on the Pacific coast of Ecuador, are unlikely to contribute diaspores to the Caribbean and/or tropical Western Atlantic (Vela Diaz, 2013; Anon., 2022).

Calophyllum brasiliense, *C. brasiliense* var. *brasiliense*, *and C. longifolium* are widely distributed in wet tropical biomes throughout Central and South America. *C. brasiliense* var. *antillanum*, which grows in wet tropical biomes in Costa Rica, Dominican Republic, Haiti, Jamaica and Windward Islands, has been introduced to Bermuda, southern Florida and Trindad-Tobago. *C. brasiliense* var. *rekoi* is widely distributed in seasonally dry tropical biomes throughout Central America as far north as southern Mexico. *C. mesoamericanum* is confined to wet tropical biomes in Costa Rica. *C. pachyphyllum* is widely distributed in wet tropical biomes throughout the Amazon Basin (Van Roosmalen, 1985; Vela Diaz, 2013; Anon., 2022).

Calophyllum inophyllum L, an Old World species, has been introduced into several regions well outside its native range (Eastern Africa to Eastern Pacific), including Bermuda and southern Florida, Central America (Nicaragua and Costa Rica), Caribbean (Cuba, Puerto Rico, Leeward Islands and Trinidad-Tobago), West Africa (The Gambia, Guinea, Ivory Coast, Ghana, Nigeria, Cameroon, Gabon and Congo), and Central Pacific (Line Islands, Phoenix Islands, Society Islands, Marquesas Islands, Tuamotu Island, Tubuai Island, Pitcairn Island and Hawaii) (Hemsley, 1885; Britton, 1918; Hutchinson and Dalziel, 1954; Stevens, 1980; Gunn *et al.*, 1999; Perry and Dennis, 2010; Vela Diaz, 2013; Anon., 2022).

Calophyllum africanum Cheek & Q.Luke, which is the only species of *Calophylum* known to be endemic to NW Africa, is restricted to seasonally dry tropical biomes in Mali (Anon., 2022), and is unlikely to contribute diaspores to the Eastern Atlantic.

Although *Calophyllum calaba* L. has frequently been cited as a species occurring in the New World (Furtado, 1941; Weaver, 1990; Gunn *et al.*, 1999; Perry and Dennis, 2010), it is now recognised as a synonym of *C. brasiliense* within this region (Anon., 2022), and that the typified species of *C. calaba* L. is restricted to the Old World, ranging from Sri Lanka to Malesia (Stevens, 1980a, b; Anon., 2022).

Some species of *Calophyllum* are economically important, particularly in terms of timber, ethno-medicinal, and potential biodiesel production (Wah, 1996; Chakrabarty and Balarkishnan, 2003; Rai, 2004; Warrier, 2010; Gupta and Gupta, 2020).

Morphology of *Calophylum* trees, fruits and seeds

Calophyllum are evergreen shrubs (rarely) and trees which can reach up to 49m in height and are easily recognised by their opposite entire leaves with close parallel venation alternating with resin canals. However, the distinction between species has often been difficult, represented by a long history of taxonomic confusion (Stevens, 1980a, b; Vela Diaz, 2013; Cabral *et al*., 2021).

Calophyllum fruits are drupe-like. The pericarp consists of a thin exocarp and a well-developed fleshy to fibrous mesocarp containing large air spaces. The endocarp consists of an outer stony layer, with or without a distinct basal plug (hilum). The inside of the endocarp is lined with a

spongy layer of aerenchymatous tissue. Endocarps may be rounded, sub-spherical, ovoid or slightly elliptic, with either an obtuse or apiculate apex. Due to their large range of morphological diversity, Stevens (1980a) noted that it is often difficult to discern clear specific differences between endocarps of separate species.

Stevens (1980a) and Vela Diaz (2013) provided taxonomic keys for most of New World and Old World *Calophyllum* species respectively. Endocarp descriptions of *Calophyllum* species reported from hydrometric catchments draining into the Caribbean and/or tropical Western Atlantic are summarized in Table 1.

Irish and NW European records of stranded *Calophyllum* drift endocarps

During the early 1900s, William L. MacGillivray discovered a *Calophyllum* (as *C. calaba* sic) drift endocarp measuring 21mm in diameter and 24mm in height, stranded on the Isle of Barra (56.9809^{o}N, 7.4568^{o}W), Outer Hebridies, NW Scotland (Nelson, 1988, 2000; Perry and Dennis, 2010). The remarkably well preserved ovoid shaped specimen, which is housed in the collections of the King's Museum, University of Aberdeen (Catalogue No. 26), represents the first known *Calophyllum* record from NW Europe (Plate 1).

On 13 March 1993, the late DC (RIP 13 January 2022) discovered a *Calophyllum* drift endocarp measuring 28mm in diameter and 31mm in height stranded on Trawalua Strand South (54.4403^{o}N, 8.4708^{o}W), County Sligo, NW Ireland. The well-preserved sub-spherical specimen exhibited a distinct basal plug and a rounded obtuse apex (Plate 2).

On 1 December 2015, AP discovered a second *Calophyllum* drift endocarp measuring 28mm in diameter and 31mm in height stranded on Kinard Beach (52.1209^{o}N, 10.2063^{o}W), Trabeg, near Sea Stack at mouth of Lispole River, Dingle, County Kerry, SW Ireland. The well preserved sub-spherical brown endocarp exhibited a distinct cream-coloured basal plug and a rounded obtuse apex (Plate 3). When rattled, it was noted that the endocarp contained a seed, and that the brown colour of the endocarp faded to an overall cream colour shortly after drying (Plate 4).

On 28 February 2019, LMN discovered a third *Calophyllum* drift endocarp measuring 28mm in diameter and 27mm in height stranded on Fanore Beach (53.1178^{o}N, 9.2889^{o}W), County Clare, on the west coast of Ireland. The heavily eroded sub-spherical specimen exhibited an obtuse apex, a distinct basal plug, and partly exposed internal spongy layer (Plates 5-6).

The current specimens represent the first three confirmed records of *Calophyllum* drift endocarps from Irish maritime shores. Details of the four NW European specimens are summarized in Table 2.

Flotation and sea-water drift dispersal potential of *Calophyllum* diaspores

The large air spaces within the mesocarp and the spongy layer of aerenchymatous tissue within

the endocarp undoubtedly facilitates the floatation properties and potential long distance sea-water dispersal of at least some *Calophyllum* diaspores (Ridley, 1930). Smith (1999) noted that although the exocarp of *Calophyllum* diaspores wrinkle on drying and are quickly lost after immersion in sea-water, leaving at best just a few basal fibres adhering to the smooth endocarp, the inner spongy layer of even damaged specimens continues to provide natural buoyancy. Flotation experiments in the U.S.A. have shown that intact *C. calaba* (sic) mesocarps can remain afloat for a maximum of two years (Gunn *et al*., 1999; Nelson, 1988, 2000; Thiel and Gutow, 2005; Perry and Dennis, 2010).

Stranded *Calophyllum* mesocarps have been recorded from a wide area in the Western Atlantic, including the Caribbean (Jamaica) (Hemsley, 1885), Gulf of Mexico (Gunn and Dennis, 1973; Gunn *et al.*, 1984; Sullivan, 2003; Norton, 2007), Bahamas (Foreman, 2007), Florida (Gunn, 1968; Perry and Dennis, 2010; Witherington and Witherington, 2017), as far north as North Carolina (Gunn and Denis, 1972; Perry and Dennis, 2010; Witherington and Witherington, 2011). Although Gunn *et al.* (1999) suggested that the mesocarps could have been either *C. inophyllum*, *C. brasiliense*, *C. calaba* (sic), and/or some other species, they acknowledged that they were unable to positively distinguish the mesocarps to species level. Perry and Dennis (2010) suggested that the stranded mesocarps found in the Gulf of Mexico as far as western Louisiana were probably *C. calaba* (sic), whereas those commonly found on the east coast of Florida and in the Florida Keys were probably derived from the introduced *C. inophyllum*, and most likely of local origin. Gunn *et al.* (1999) noted that about 50% of the *C. calaba* (sic) mesocarps contained viable seeds.

Stranded endocarps of *C. inophyllum* have been reported throughout the Old World, including the Indian and Pacific Oceans: South Africa (Muir, 1937; Hosten-Willems, 2005), Seychelles (Robertson, 1998), Christmas Island (Green, 1999; Barnes, 2004), Cocos (Keeling) Islands (Guppy, 1890; Claussen and Slip, 2002), Japan (Longhorn, 2004; Hanaoka *et al*., 2014; Kubota, 2015, 2017; Hayashi, 2020), Australia (Hacker, 1990; Smith 1990, 1991, 1994, 1999; Smith *et al.*, 1990), Papua New Guinea (Hemsley, 1885; Fortune Hopkinds, 1997), Kosrae Island, Micronesia (Sullivan and Flynn, 2009), Fiji (Smith, 1990; Ash, 1992), Solomon Islands (Hemsley, 1885; Guppy, 1906), Marshall Islands (Gunn, 1977), Midway Atoll (Wagner, 2002; Smith, 2006), Bikini Atoll (Vander Velde and Vander Velde, 2006), and Hawaii (Ebbesmeyer, 2003; Sullivan *et al*., 2006). *C. inophyllum* is essentially a coastal species producing diaspores well-adapted to sea-water dispersal for longer than 90 days without experiencing a significant decrease in germination rate (Hanoka *et al.* 2014). Indeed, *C. inophyllum* was one of the first species of plants to naturally recolonize Krakatau Island (Indonesia) following the cataclysmic volcanic eruption in 1883 (Sauer, 1988; Thornton, 1996).

Although stranded *C. inophyllum* endocarps have also been reported from The Gambia, West Africa (Verschoore, 2015), these were most likely derived from local introductions (Hutchinson

and Dalziel, 1954; Anon, 2022). It is conceivable that some of these North African *Calophyllum* endocarps could drift across to the Caribbean and Western Atlantic via the North Equatorial Current. For example, drift endocarps of the tropical West African Bitterbark Tree *Sacoglottis gabonensis* (Baill.) Urb. have been recorded, albeit rarely, from the Gulf of Mexico (Van der Ham *et al*., 2015). It has also been argued that the African Bottle Gourd *Lagenaria siceraria* (Molina) Standl. could have become naturalized in the New World by simple floating across the Atlantic during the late Pleistocene (Kistler *et al.* 2014).

Discussion

Considering that the maximum known flotation time in sea-water of *Calophyllum brasiliense* (as *C. calaba* sic) mesocarps in the Western Tropical Atlantic is about two years, it conceivable that at least some could drift from the Caribbean Region via the Antilles Current, Gulf Stream and North Atlantic Drift to NW Europe within the estimated minimum passive trans-Atlantic flotation time interval of 14 to 18 months (Quigley *et al*., 2016), which suggests that the NW European endocarps were true peregrine drifters.

At least five species and three varieties of *Calophyllum* are known to occur in hydrometric catchments draining into the Caribbean and/or tropical Western Atlantic. However, apart from *C. brasiliense*, the maximum flotation properties and sea-water dispersal potential of the other diaspores is currently unknown. As Steven's (1980a) remarked, it is difficult to discern clear specific differences between drift endocarps of separate species.

In contrast to the ovoid-shaped Scottish endocarp, the three Irish specimens were sub-spherical which suggests that the NW European records may represent two different species, possibly either *C. brasiliense* and/or *C. inophyllum*. DNA analysis may confirm this hypothesis.

Despite the fact that 95% (c.180) of *Calophyllum* species occur in the Old World, it is surprising that all of the drift endocarps reported to date from this vast area have been listed as *C. inophyllum*. Perhaps some of these drift endocarps may represent other *Calophyllum* species.

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References

Anon. (2022) The Plant List – a working list of all plant species <http://www.theplantlist.org/tpl1.1/search?q=Calophyllum> (Accessed 26 October 2022).

Ash, J. (1992) Vegetation ecology of Fiji: past, present, and future perspectives. *Pacific Science* **46**:

111-127.

Barnes, D. K. A. (2004) Natural and plastic flotsam stranding in the Indian Ocean. *In* Davenport, J. and Davenport, J. L. (eds) *The Effects of Human Transport on Ecosystems: Cars and Planes, Boats and Trains*. Proceedings of a seminar of the National Committee for Biology, 1-2 April 2003. pp 193-205. Royal Irish Academy, Dublin.

Britton, N. L. (1918) *Flora of Bermuda*. Charles Scribner's, New York. 612pp.

Cabral, F. N., Trad, R. J., Am, B. S., Maciel, J. R., Amaral, M. C. E. and Stevens, P. (2021) Phylogeny, divergence times, and diversification in Calophyllaceae: Linking key characters and habitat changes to the evolution of Neotropical Calophylleae. *Molecular Phylogenetics and Evolution* **157**: 107041.

Chakrabarty, T. and Balarkishnan, N. P. (2003) Ethnobotany of the Andaman and Nicobar Islands, India – a review. *Journal of Economic Taxonomic Botany* **27**: 869-893.

Claussen, J. and Slip. D. (2002) *The status of exotic plants on the Cocos (Keeling) Islands, Indian Ocean*. Report to Parks Australia North, Cocos (Keeling) Islands. 17pp.

Ebbesmeyer, C. (2003) Drift seed necklace recipe. *The Drifting Seed* **9**: 12.

Foreman, P. (2007) Sea-beaning in the Bahamas. *The Drifting Seed* **13**: 8-9.

Fortune Hopkinds, H. (1997) A study on drift fruits and seeds in Papua New Guinea. *The Drifting Seed* **3**: 3-6.

Funk, V., Hollowell, T., Berry, P., Kelloff, C. and Alexander, S. N. (2007) Checklist of the plants of the Guiana Shield (Venezuela: Amazonas, Bolivar, Delta Amacuro; Guyana, Surinam, French Guiana). *Contributions from the United States National Herbarium* **55**. 584pp.

Furtado, C. X. (1941) The typification of *Calophyllum calaba* L. *Gardens Bulletin Singapore* **11**: 258-260.

Green, P. T. (1999) Greta's Garbo: stranded seeds and fruits from Greta Beach, Christmas Island, Indian Ocean. *Journal of Biogeography* **26**: 937-946.

Gunn, C. R. (1968) Stranded seeds and fruits from the southeastern shore of Florida. *Garden Journal* **18**: 43-54.

Gunn, C. R. (1977) *Merremia discoidesperma*: its taxonomy and capacity of its seeds for ocean drifting. *Economic Botany* **31**: 237-252.

Gunn, C. R., Andrews, J. M. and Paradine, P. J. (1984) Stranded seeds and fruits from the Yucatan Peninsula. *Anales del Instituto de Biologia de la Universidad Nacional Autonoma de Mexico. Series Botanica* **53**: 21-60.

Gunn, C. R. and Dennis, J. V. (1972) Stranded tropical seeds and fruits collected from Carolina beaches. *Castanea* **37**: 195-200.

Gunn, C. R. and Dennis, J. V. (1973) Tropical and temperate stranded seeds and fruits from the Gulf of Mexico. *Contributions in Marine Science* **17**: 111-121.

Gunn, C. R., Dennis, J. V. and Paradine, P. J. (1999) *World guide to tropical drift seeds and fruits*. Krieger Publishing Company, Malabar, Florida. 240pp.

Guppy, H. B. (1890) *The dispersal of plants as illustrated by the flora of the Keeling or Cocos Islands*. *Journal of the Transactions of the Victoria Institute or the Philosophical Society of Great Britain* **24**: 267-306.

Guppy, H. B. (1906) *Observations of a naturalist in the Pacific between 1896 and 1899*. Volume **2**. Macmillan & Co. Ltd., London. 627pp.

Gupta, S. and Gupta, P. (2020) The Genus *Calophyllum*: review of ethnomedicinal uses, phytochemistry and pharmacology. *In* Singh, J., Meshram, V. and Gupta, M. (eds) *Bioactive Natural Products in Drug Discovery*. Springer Nature, Singapore. pp 215-242.

Hacker, J. B. (1990) Drift seeds and fruit on Raine Island, northern Great Barrier Reef, Australia. *Journal of Biogeography* **17**: 19-24.

Hanaoka, S., Chien, C.-T., Chen, S.-Y., Watanabe, A., Setsuko, S. and Kato, K. (2014) Genetic structures of *Calophyllum inophyllum* L., a tree employing sea-drift seed dispersal in the northern extreme of its distribution. *Annals of Forest Science* **71**: 575-584.

Hayashi, S. (2020) Tropical drift fruits and seeds on Aichi Prefecture, Japan. *Journal of Japan Driftological Society* **18**: 1-5.

Hemsley, E. B. (1885) *Report on the Scientific Results of the Voyage of H.M.S. Challenger during the years 1873-76. Botany 1*. Her Majesty's Stationery Office, London. 1125pp.

Hosten-Willems, L. (2005) Beachcombing in Port Elizabeth – South Africa. *The Drifting Seed* **11**: 5-9.

Hutchinson, J. and Dalziel, J. M. (1954) *Flora of West Tropical Africa* (2nd Edition). Crown Agents for Overseas Governments and Administrations, London.

Kistler, L., Montenegro, A., Smith, B. D., Gifford, J. A., Green, R. E., Newsom, L. A. and Shapiro, B. (2014) Transoceanic drift and the domestication of African bottle gourd in the Americas. *PNAS* **111**: 2937-2941.

Kubota, S. (2015) Fruit of *Calophyllum inophyllum* L. washed ashore at a coast of Wakayama, Japan as the third record in this Prefecture. *Journal of the Japan Driftological Society* **13**: 65.

Kubota, S. (2017) Fruit of *Calophyllum inophyllum* L. washed ashore at a coast of Shirahama Town, Wakayama Prefecture, Japan as the fourth record. *Journal of the Japan Driftological Society* **56**: 1.

Longhorn, E. (2004) A letter to all drifters, Part 2. *The Drifting Seed* **10**: 6.

Muir, J. (1937) The seed-drift of South Africa and some influences of ocean currents on the strand vegetation. *Botanical Survey Memoir* **No. 16**. 108pp. Department of Agriculture and Forestry, Union of South Africa.

Nelson, E. C. (1988) Exotic drift fruits and seeds from the coasts of Britain and adjacent islands.

Journal of the Royal Institution of Cornwall (New Series) **10**: 147-177.

Nelson, E. C. (2000) *Sea Beans and Nickar Nuts. A handbook of exotic seeds and fruits stranded on beaches in north-western Europe*. BSBI Handbook **No. 10**. Botanical Society of the British Isles, London. 156pp.

Norton, E. (2007) The Padre Island National Seashore "Crunch-Squish Walk" Adventure. *The Drifting Seed* **13**: 3-6.

Perry, E. and Dennis, J. V. (2010) *Sea-Beans from the tropics: a collector's guide to sea-beans and other tropical drift on Atlantic shores*. Krieger Publishing Company, Malabar, Florida. 217pp.

Quigley, D. T. G., Gainey, P. A., Moss, H., Judge, W., Venn, E. and Dinsdale, A. (2016) First records of Jamaican walnuts *Juglans jamaicensis* (Juglandaceae) from Irish and UK waters, together with observations on other walnut species reported from NW Europe. *New Journal of Botany* **6**: 102-108.

Rai, P. P. (2004) Country status report on medicinal and aromatic plants in Papua New Guinea. *In* Paroda, R., Dasgupta, S., Mai, B., Ghosh, S. P. and Pareek, S. K. (eds). *Proceeding of the Expert Consultation on Promotion of Medicinal and Aromatic Plants in the Asia-Pacific Region*, Bangkok, Thailand, 2-3 December 2013. pp 186-200.

Ridley, H. N. (1930) *Dispersal of plants throughout the world*. Reeve, London. 744pp.

Robertson, A. (1998) *Gigasiphon macrosiphon* – a case of mistaken identity. *The Drifting Seed* **4**: 7.

Sauer, J. D. (1988) *Plant migration – the dynamics of geographic patterning in seed plant species*. University of California Press, Berkley and Los Angeles, California.

Smith, J. M. B. (1990) Drift disseminules on Fijian beaches. *New Zealand Journal of Botany* **38**: 13-20.

Smith, J. M. B. (1991) Tropical drift disseminules on southeast Australian beaches. *Australian Geographical Studies* **29**: 335-369.

Smith, J. M. B. (1994) Patterns of disseminule dispersal by drift in the north-west Coral Sea. *New Zealand Journal of Botany* **32**: 453-461.

Smith, J. M. B. (1999) *Australian Driftseeds: a compendium of seeds and fruits commonly found on Australian beaches*. School of Human and Environmental Studies. University of New England, Armidale, New South Wales, Australia. 123pp.

Smith, J. M. B. (2006) Driftseeds and seabirds. *Drifting Seed* **12**: 11-12.

Smith, J. M. B., Heatwole, H., Jones, M. and Waterhouse, B.M. (1990) Drift disseminules on Cays of the Swain Reefs, Great Barrier Reef, Australia. *Journal of Biogeography* **17**: 5-17.

Stevens, P. F. (1980a) A revision of the Old World species of *Calophyllum* (Guttiferae). *Journal of the Arnold Arboretum* **61**: 117-699.

Stevens, P. F. (1980b) The correct names for the three elements in the protologue of *Calophyllum*

calaba L. *In* Manilal, K. S. (Ed.) *Botany and History of Hortus Malabaricus*. A.A. Balkema, Rotterdam. pp 168-176.

Sullivan, C., Flynn, T. and Sullivan, G. (2006) Stranded fruits, seeds and other drift on Kauai beaches. *The Drifting Seed* **12**: 7-9.

Sullivan, G. (2003) Sea-bean collection at University of Texas at Austin Marine Science Institute. *The Drifting Seed* **9**: 7-9.

Sullivan, G. and Flynn, T. (2009) Drift seeds from a lonely beach in Micronesia. *The Drifting Seed* **15**: 7-8.

Thiel, M. and Gutow, L. (2005) The ecology of rafting in the marine environment. 1. The floating substrata. *Oceanography and Marine Biology: An Annual Review* **42**: 181-264.

Thornton, I. (1996) *Krakatau – The destruction and reassembly of an island ecosystem*. Harvard University Press, Cambridge, Massachusetts and London, England. 346pp.

Van Roosmalen, M. G. M. (1985) *Fruits of the Guianan Flora*. Utrecht and Wageningen Institute of Systematic Botany, Silvicultural Department of Wageningen University. 483pp.

Van der Ham, R., Van Andel, T., Butcher, L., Hanno, I., Lambrechts, T., Lincicome, K., Mikkelsen, P., Mina, J., Patterson, B., Perry, E. and Romance, M. (2015) Furrowed Blister Pods stranded on northern Atlantic Ocean coasts represent an undescribed *Sacoglottis* (Humiriaceae) endocarp most similar to the fossil *Sacoglottis costata*. *Journal of the Botanical Research Institute of Texas* **9**: 137-147.

Vander Velde, N. and Vander Velde, B. (2006) Mary's Bean and other small drift materials of plant origin found on Bikini Atoll. *Plant Species Biology* **21**: 41-48.

Vela Diaz, D. W. (2013) Multivariate analysis of morphological and anatomical characters of *Calophyllum* (Calophyllaceae) in South America. *Botanical Journal of the Linnean Society* **171**: 587-626.

Verschoore, K. (2015) Seeds and fruits cast ashore in Fajara, The Gambia (West Africa). *The Drifting Seed* **21**: 4-5.

Wah, C. L. (1996) Marketing indigenous nuts in Vanuatu – a private enterprise perspective. *In* Stevens, M. L., Bourke, R. M. and Evans, B. R. (Eds.) South Pacific Indigenous Nuts. Proceedings of a Workshop held from 31 October to 4 November 1994 at Le Lagon Resort, Port Vila, Vanuatu. *ACIAR Proceedings* **No. 69**. p. 79.

Wagner, B. F. (2002) Driftseeds of Midway Atoll National Wildlife Refuge. *The Drifting Seed* **8**: 7-8.

Warrier, K. C. S. (2010) *Calophyllum inophyllum* L. Chapter 18: 169-178. *In* Krishnakumar, N., Palanisamy, K., Hegde, M., Warrier, K. C. S. and Krishnamoorthy, M. (eds) *Manual of Economically Important Forestry Species in South India*. Institute of Forest Genetics and Tree Breeding (Indian Council of Forestry Research and Education), Coimbatore, Tamil Nadu.

Weaver, P. L. (1990) *Calophyllum calaba* L. Maria, Santa-Maria. Guttiferae – Mangosteen family. *In* Burns, R. M. and Honkala, B. H. (eds) *Silvics of North America – Hardwoods* **2**. United States Forestry Service (USFS), United States Department of Agriculture (USDA), Washington D.C.

Witherington, B. and Witherington, D. (2011) *Living beaches of Georgia and the Carolinas – A beachcomber's guide*. Pineapple Press Inc., Saratosa, Florida, U.S.A. 342pp.

Witherington, B. and Witherington, D. (2017) *Florida's living beaches – a guide for the curious beachcomber* (2nd Edition). Pineapple Press Inc., Saratosa, Florida, U.S.A. 390pp.

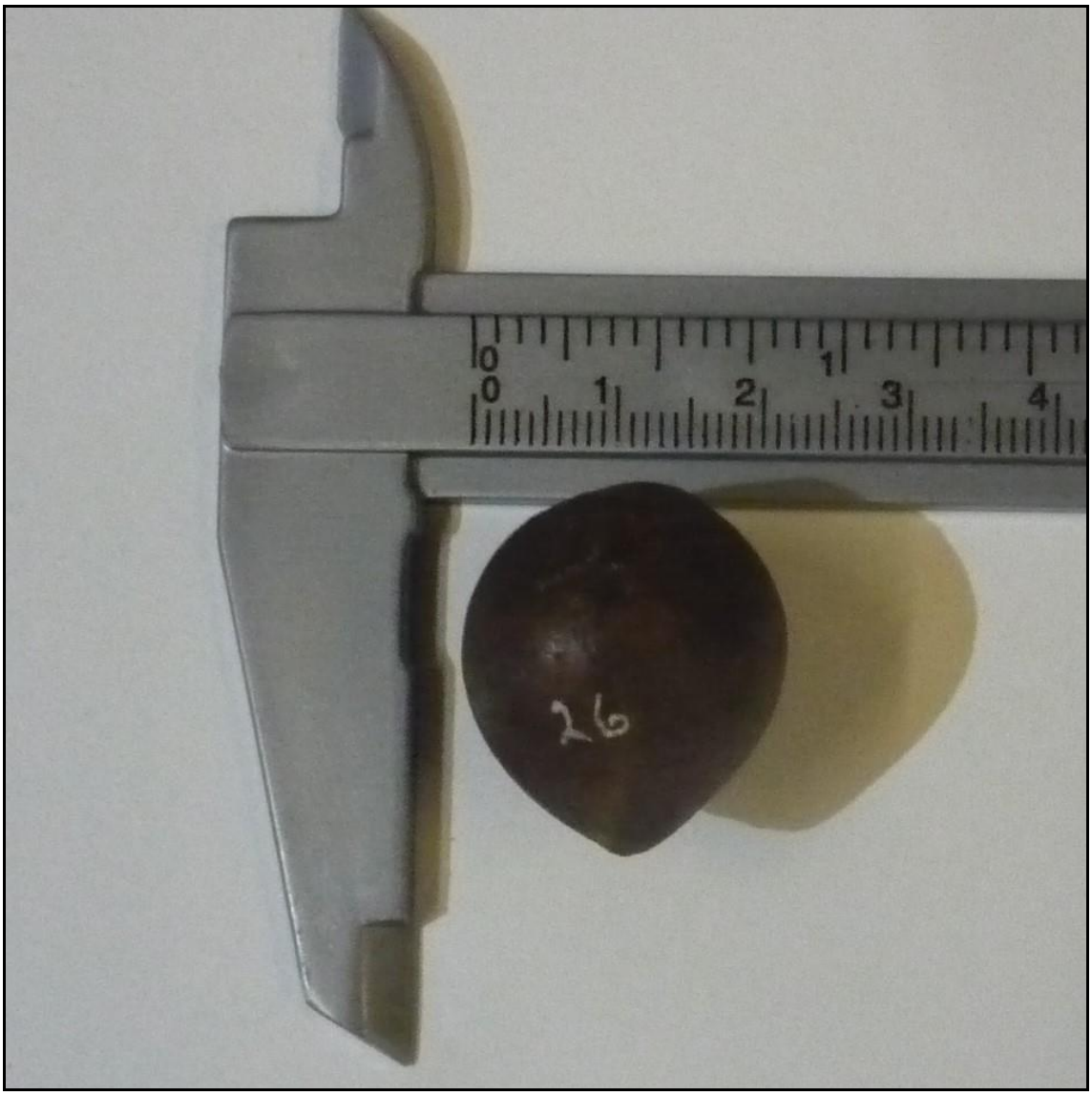

PLATE 1. *Calophyllum* endocarp, Isle of Barra, Outer Hebrides, NW Scotland, c. 1900. Photograph: Melia Knecht.

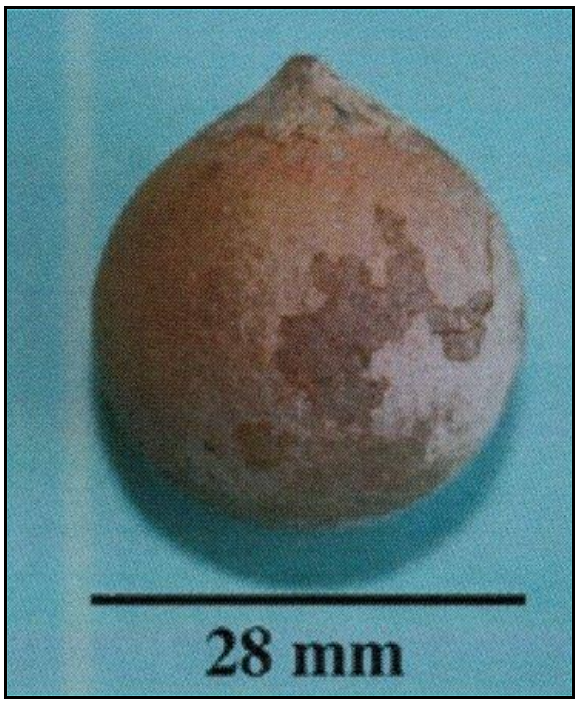

PLATE 2. *Calophyllum* endocarp, Trawalua Strand South, County Sligo, 13 September 1993. Photograph: Don Cotton.

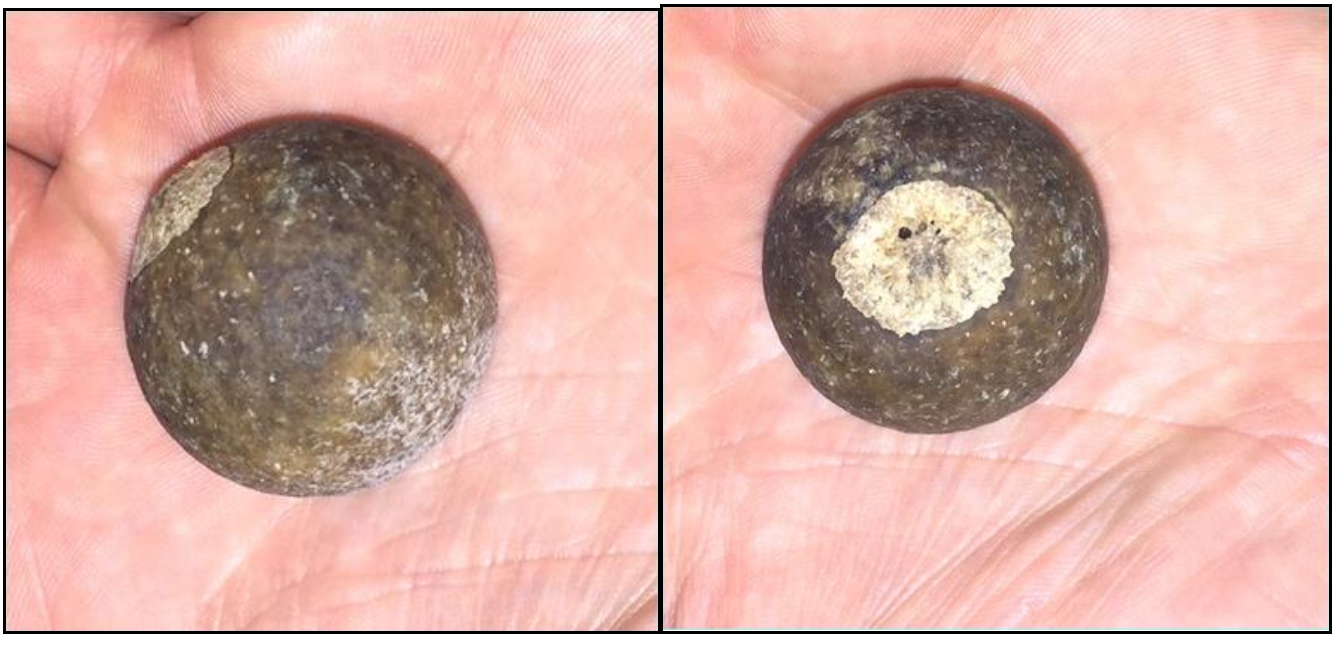

PLATE 3. *Calophyllum* endocarp, Kinard Beach, Dingle, County Kerry, 1 December 2015. Photograph: Alan Pyne.

PLATE 4. *Calophyllum* endocarp, Kinard Beach, Dingle, County Kerry, 1 December 2015. Photograph: Declan Quigley.

PLATE 5. *Calophyllum* endocarp, Fanore, County Clare, 28 February 2019. Photograph: Liam McNamara.

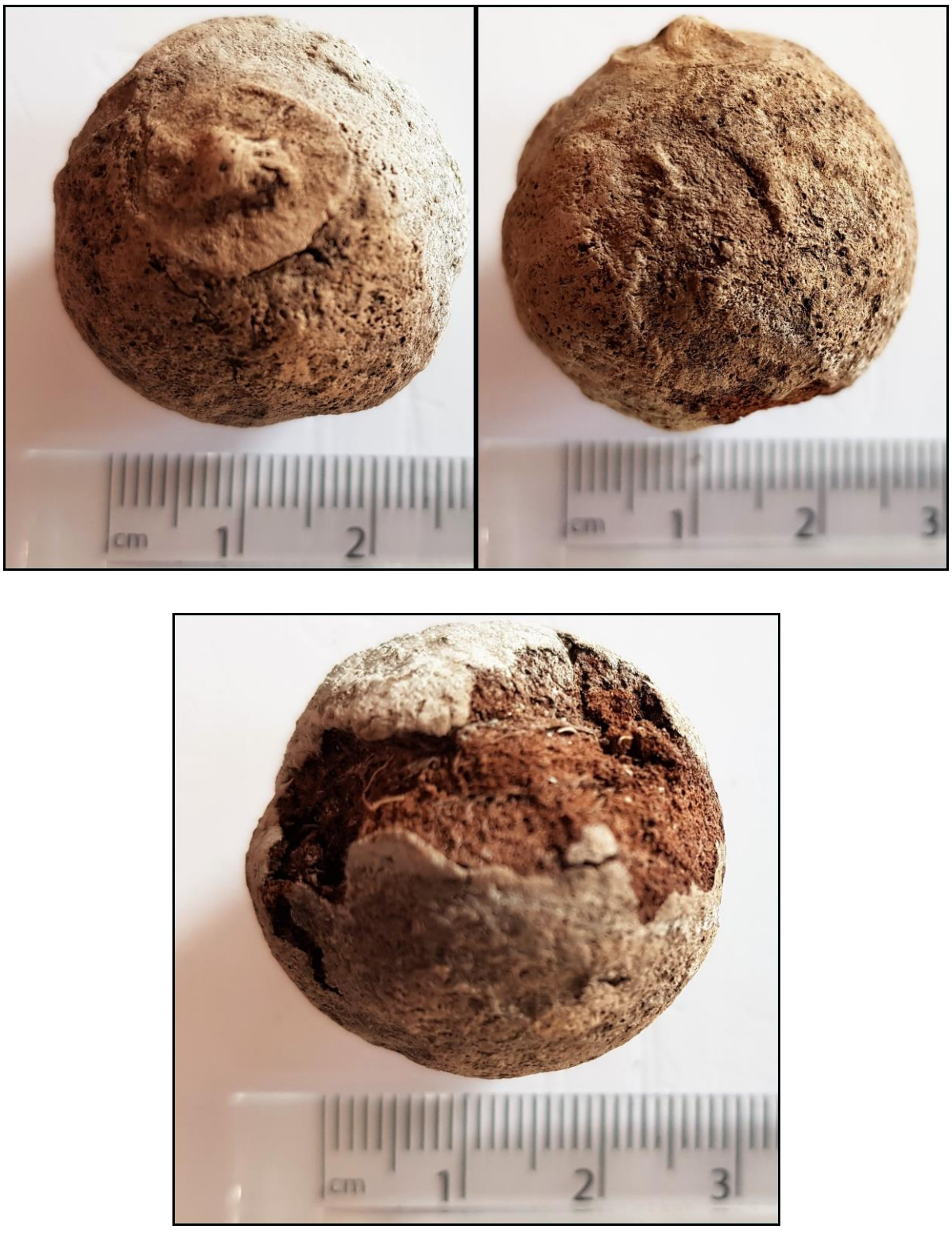

PLATE 6. *Calophyllum* endocarp, Fanore, County Clare, 28 February 2019. Photograph: Liam McNamara.

TABLE 1. Morphological and meristic characters of *Calophyllum* endocarps reported from hydrometric catchments draining into the Caribbean and/or tropical Western Atlantic

Species	**Shape**	**Dimensions (mm)**	**Apex**	**Basal Plug**	**Reference**
Calophyllum brasiliense	globose or ovoid	16-27 x 12-24	obtuse	present	Vela Diaz (2013)
Calophyllum longifolium	ovoid	12-33 x 10-28	obtuse	present	Vela Diaz (2013)
Calophyllum pachyphyllum	ovoid	13-26 x 12-25	obtuse	present	Vela Diaz (2013)
Calophyllum mesoamericanum	ovoid	22-28 x 19-23	obtuse	present	Vela Diaz (2013)
Calophyllum inophyllum	sub-spherical	17-39 x 19-34	obtuse (very rarely apiculate)	diameter 4-10 mm	Stevens (1980)
Calophyllum calaba	spherical, to ovoid or ellipsoid	50-115 x 50-80	obtuse	smooth, unmarked	Stevens (1980)

TABLE 2. NW European records of Laurelwood *Calophyllum* drift endocarps.

1. **Date:** early 1900s. **Location:** Isle of Barra, Outer Hebridies, NW Scotland. **Latitude (°N):** 56.9809. **Longitude (°W):** 7.4568. **Recorder:** William L. MacGillivray. **Diameter (mm):** 21. **Depth (mm):** 24. **Ratio (Diameter/Depth):** 0.88. **Reference:** Nelson (1990, 2000). **Collection Reference:** King's Museum (Aberdeen University) No. 26. **Notes:** as *Calophyllum calaba*.
2. **Date:** 13 March 1993. **Location:** Trawalua Strand South, County Sligo, NW Ireland (G6954). **Latitude (°N):** 54.4403. **Longitude (°W):** 8.4708. **Recorder:** Don Cotton. **Diameter (mm):** 28. **Depth (mm):** 31. **Ratio (Diameter/Depth):** 0.90. **Reference:** this paper. **Collection Reference:** Don Cotton's private collection. **Notes:** as *Calophyllum* sp.
3. **Date:** 1 December 2015. **Location:** Kinard Beach, Trabeg, near Sea Stack at mouth of Lispole River, Dingle, County Kerry, SW Ireland. **Latitude (°N):** 52.1209. **Longitude (°W):** 10.2063. **Recorder:** Alan Pyne. **Diameter (mm):** 28. **Depth (mm):** 31. **Ratio (Diameter/Depth):** 0.90. **Reference:** this paper. **Collection Reference:** Alan Pyne's private collection. **Notes:** as *Calophyllum* sp.
4. **Date:** 28 February 2019. **Location:** Fanore Beach, Fanore Mor, County Clare, W Ireland. **Latitude (°N):** 53.1200. **Longitude (°W):** 9.2882. **Recorder:** Liam McNamara. **Diameter (mm):** 28. **Depth (mm):** 27. **Ratio (Diameter/Depth):** 1.04. **Reference:** this paper. **Collection Reference:** Liam McNamara's private collection. **Notes:** as *Calophyllum* sp.