

## FIRST RECORDS OF PERSIAN WALNUTS *JUGLANS REGIA* L. (JUGLANDACEAE: CARDIOCARYON) STRANDED ON THE IRISH COAST AND A REVIEW OF NORTH ATLANTIC RECORDS

\*Declan T. G. Quigley<sup>1</sup> and Liam McNamara<sup>2</sup>

<sup>1</sup>*Sea Fisheries Protection Authority, Eastern Region, West Pier, Howth, Co. Dublin, Ireland.*

<sup>2</sup>*Derreen, Craggagh, Fanore, Co. Clare, Ireland.*

\*Corresponding author e-mail: <declan.quigley@sfpa.ie>

### Abstract

On 13 September 2017, LMN discovered an intact Persian Walnut *Juglans regia* L. measuring 39mm total length and 30mm maximum diameter stranded on Fanore Beach, Fanore Mor, County Clare (53.119653°N 9.288190°W), on the Atlantic coast of western Ireland. On 9 March 2019, LMN discovered another intact specimen of *J. regia* measuring 41mm total length and 29mm maximum diameter stranded at Goilin, Carrowntedaun, Lahinch, County Clare (53.119959°N, 9.288165°W). The specimens represent the first known records of stranded *J. regia* walnuts from Irish maritime shores. The occurrence and possible provenance of stranded *J. regia* walnuts on Irish and other North Atlantic maritime shores is reviewed.

**Key words:** Persian Walnut, *Juglans regia*, stranded walnuts, Irish and NW European waters.

### Introduction

The Persian Walnut (*Juglans regia* L.) is one of the most economically important trees cultivated worldwide, primarily for its nutritious nuts and high-quality hard-wood timber (Boriss *et al.*, 2006; Taha and Al-Wadaan, 2011; Smith, 2020). During 2018, total global production of in-shell walnuts amounted to 3.66 million tonnes. Although 53 countries contributed to total world production, the top five accounted for 81.5%: viz. China (43.3%), U.S.A. (16.7%), Iran (11.2%), Turkey (5.9%) and Mexico (4.4%) <<http://www.fao.org/faostat/en/#search/walnut>>. California accounts for 99% of the U.S.A.'s *J. regia* walnut production, centred in the Sacramento and San Joaquin valleys (Hartshorn, 1999; Boriss *et al.*, 2006; Bernard *et al.*, 2018). The main production states in Mexico include Chihuahua, Sonora, Coahuila, Durango and Nuevo Leon.

It is generally accepted that after the last glaciation, *J. regia* survived in almost completely isolated stands in central Asia (Aradhya *et al.*, 2007; Dong *et al.*, 2017; Mu *et al.*, 2017; Vischi *et al.*, 2017; Bai *et al.*, 2018; Zhang *et al.*, 2019; Song *et al.*, 2020), and that ancient humans subsequently dispersed the species both eastwards across Asia and westwards to Europe *via* trade and cultural expansion (Pollegioni *et al.*, 2014, 2015, 2017).

*J. regia* was introduced to the U.K. during the late 1600s (Kerr, 1993; Hemery *et al.*, 2005; Johnson and More, 2006), and to the Americas by Spanish missionaries during the late 1700s, where it thrives in sub-tropical regions of Chile and California (Tomás, 2000). One of the oldest walnut trees in Ireland, a massive specimen of *J. regia* growing in the grounds of Saint Mary's Priory, Tallaght, Dublin, where it is colloquially known as Saint Maelruan's Tree, is thought to have been planted around 1760. Although the tree was struck by lightning during 1795 and split into several parts, it survived, and after 260 years still produces nuts in abundance (Zucchelli, 2016) (Plates 1-3). Several varieties, cultivars and hybrids of *J. regia* are well established under ambient conditions in the National Botanic Gardens in Dublin (Anon, 2017).

The Persian Walnut is a large long-lived monoecious tree, reaching a maximum height and crown width of 35m and 900m<sup>2</sup> respectively, a trunk diameter and circumference of up to 3m and 11.5m respectively, and a deep rooting system extending down to 6–7m and 12m laterally, characteristics which impart significant drought and stress tolerance. Walnut trees grow primarily in a humid temperate climate so that those found in tropical latitudes are restricted to rather high altitudes with good rainfall, while those found in arid regions are restricted to the canyons of streams (Manning, 1957; Wani *et al.*, 2014, 2016).

The fruit is drupe-like and spherical, with a green, dehiscent pericarp (husk), which releases a single nut (endocarp) when mature. The hard light brown oblong nut, round in cross section, is covered with shallow irregular grooves, and measures 30-50mm in length and 25-30mm in width; the apex is short and minute-pointed, and the base flat or tapered. The nut contains an edible kernel (seed) covered with a thin, yellow to brown papery layer (pellicle) (Gunn and Dennis, 1999; Molnar *et al.*, 2011).

### **Persian Walnuts *Juglans regia* stranded on Irish and NW European maritime shores**

On 13 September 2017, LMN discovered an intact Persian Walnut *Juglans regia* L. measuring 39mm total length and 30mm maximum diameter stranded on Fanore Beach, Fanore Mor, County Clare (53.119653°N 9.288190°W), on the Atlantic coast of western Ireland. On 9 March 2019, LMN discovered another intact specimen of *J. regia* measuring 41mm total length and 29mm maximum diameter stranded at Goilin, Carrowntedaun, Lahinch, County Clare (53.119959°N, 9.288165°W) (Plates 4-5). The current specimens represent the first known records of *J. regia* walnuts stranded on Irish maritime shores. The occurrence and possible provenance of stranded *J. regia* walnuts on Irish and other North Atlantic maritime shores is reviewed.

## **Discussion**

Although Persian Walnuts are generally thought to be naturally dispersed by gravity and animals (Ridley, 1930; Grimshaw, 2003; Van der Ham, 2012), and for millennia by humans (Pollegioni *et al.*, 2014, 2015, 2017), they usually have good floatation properties, and some may also be dispersed by water (hydrochory). However, hydrochorously dispersed walnuts are unlikely to be viable because they are not completely waterproof; the sutures between the two halves of the nut eventually allow the penetration of both fresh and salt water, thus killing the seed (Gunn, 1968). Nevertheless, during flood conditions, some walnuts are inevitably carried down rivers and out to sea where they drift in ocean currents for various periods of time before either sinking or stranding.

The maximum reported floatation period for *J. regia* walnuts under test conditions in sea water is 15 months (Gunn and Dennis, 1999; Nelson 2000; Perry and Dennis, 2010). Although it is generally considered that stranded *J. regia* walnuts were probably discarded locally, considering the estimated time interval for passive eastward long-range dispersal of drift objects from south-eastern U.S.A. to Western Europe, ranging from at least 14 to 18 months (Quigley *et al.*, 2016), and the long-term potential floatation properties of *J. regia* walnuts (15 months), it is conceivable that some specimens could have originated somewhere along the eastern coast of North America, and passively drifted *via* the Gulf Stream and North Atlantic Drift to western Ireland and/or other NW European shores.

In the NW Atlantic, *J. regia* walnuts are not uncommonly found stranded on maritime beaches in the Gulf of Mexico, including the Yucatan Peninsula (Mexico), Texas, and south-eastern Florida (Gunn, 1968; Gunn and Dennis, 1999; Gunn *et al.*, 1984; Sullivan, 2004; Perry and Dennis, 2010). Stranded *J. regia* walnuts have also been reported from California, on the Pacific coast of the U.S.A. (Ebbesmeyer, 1977).

In the NE Atlantic, stranded *J. regia* walnuts are commonly found along the Dutch coast but are generally considered to be either of local origin or discarded imported walnuts (Brochard and Cadée, 2005; Van der Ham *et al.*, 2013). Cadée (1996, 1997) discussed the human factors and palaeontological implications that need to be considered when interpreting the potential provenance of stranded non-native drift seeds. Stranded ‘walnuts’ were reported from the Norwegian coast during the early 1880s, but Alm (2003) considered that these may have been stranded tropical Sea Hearts (*Entada gigas* L.).

Paul Gainey (pers. comm.) remarked that over the years he had spotted at least five *J. regia* walnuts stranded on the north coast of Cornwall (U.K.), mostly from Perranporth and at least one from Gwithian Sands. He also related that over the last 5-6 years Chris Easton had seen three specimens at Perranporth, most recently during June-July 2020. Over the same period, Tracey Williams recorded a stranded specimen near Newquay. On 13 March 2019, Terena

Hillary discovered two specimens stranded at Perranporth, along with several tropical seeds, including two Grey Nickar Nuts (*Guilandina bonduc* L.), one Horse-Eye Bean (*Mucuna* sp.), and two Morning Glory (*Ipomoea*-type) seeds. On 21 March 2019, Terena Hillary recorded another stranded specimen of *J. regia* at Perranporth, along with three *G. bonduc*, one *Mucuna* sp., two *Ipomoea*-type seeds, three *E. gigas*, one Starnut (*Astrocaryum* sp.), and one Violet Sea Snail (*Janthina janthina* (L.)). The stranding of three *J. regia* walnuts in Cornwall and another in County Clare over a two week period during March 2019 suggests that these four walnuts may have arrived in U.K. and Irish waters around the same time. The co-occurrence of several species of tropical drift seeds along with three *J. regia* walnuts in Cornwall during March 2019 strongly suggests that all of these disseminules may have originated from the same general region in the western tropical Atlantic.

Despite several years of regular beachcombing along the County Clare coast, LMN has only recently found two specimens of stranded *J. regia* walnuts. Similarly, Rosemary Hill and Sabine Springer (pers. comm.) have never found any stranded specimens either in the southwest (County Kerry) or on the north coast of County Clare respectively. Dan Minchin (pers. comm.) recalled having occasionally found stranded *J. regia* walnuts on the Irish coast during the 1990s. Although the dearth of published records from the Irish, U.K. and other NW European countries may be related to a lack of recording effort, it is more likely due the perception (possibly erroneous), that all stranded *J. regia* walnuts were locally discarded.

Although it is possible that genetic analyses may reveal the origin of stranded walnuts, they are unlikely to explain the mechanisms as to how they arrived on maritime shorelines, perhaps several thousand miles from where they were originally growing. Considering the widespread cultivation and international trade in *J. regia*, it is possible that stranded *J. regia* walnuts could be derived from many different regions in either the Old or New World. However, considering their long-term flotation properties, it is possible that some walnuts stranded on NW European shores may represent true trans-Atlantic drifters, most likely from the Atlantic coast of Mexico, the world's fifth largest producer of *J. regia* walnuts. If genetic techniques revealed that the Fanore walnuts were of Mexican origin, it might lend some support to the peregrine hypothesis, but they still may have been imported into Ireland from Mexico and discarded locally.

At least twenty two extant species of walnut (*Juglans*) are currently recognised worldwide <[www.theplantlist.org](http://www.theplantlist.org)>. Four species of stranded walnuts have now been recorded from Irish maritime shores: Jamaican Walnut (*J. jamaicensis* C. DC.), Black Walnut (*J. nigra* L.), White Walnut (*J. cinerea* L.), and Persian Walnut (*J. regia*) (Quigley *et al.*, 2016, 2020; Quigley and Minchin, 2019; Quigley and McNamara, 2020; this paper). The Japanese Walnut (*J. ailantifolia* Carrière) and California Black Walnut (*J. californica* S. Watson) have also been recorded from the Dutch coast (Van der Ham *et al.*, 2013, 2014).

### **Acknowledgements**

We are grateful to Dan Minchin (Killaloe, Co. Clare), Paul Gainey, Terena Hillary, Tracey Williams and Chris Easton (Cornwall, U.K.) for permission to include their unpublished records, and to Rosemary Hill (Waterville, Co. Kerry) and Sabine Springer (Kinvara, Co. Clare) for their helpful comments.

### **References**

- Anon. (2017) National Botanic Gardens, Glasnevin. Far Grounds – *Aesculus*, *Betula* etc. (A4) Loc. 5. <<http://www.botanicgardens.ie/nbg/arealsts/a4.pdf>> Last updated: October 2017).
- Alm, T. (2003) Exotic drift fruits in Norway: vernacular names, beliefs and uses. *Journal of Ethnobiology* **23**: 227-261.
- Aradhya, M. K., Potter, D, Gao, F. and Simon, C. J. (2007) Molecular phylogeny of *Juglans* (Juglandaceae): a biogeographical perspective. *Tree Genetics and Genomes* **3**: 363-378.
- Bai, W.-N., Yan, P.-C., Zhang, B.-W., Woeste, K. E., Lin, K. and Zhang, D.-Y. (2018) Demographically idiosyncratic responses to climate change and rapid Pleistocene diversification of the walnut genus *Juglans* (Juglandaceae) revealed by whole-genome sequences. *New Phytologist* **217**: 1726-1736.
- Bernard, A., Lheureux, F. and Dirlewanger, E. (2018) Walnut: past and future of genetic improvement. *Tree Genetics & Genomes* **14**, 1.  
<<https://doi.org/10.1007/s11295-017-1214-0>>
- Boriss, H., Brunke, H. and Kreith, M. (2006) Commodity Profile: English Walnuts. Agricultural Issues Centre, University of California. <<https://aic.ucdavis.edu/wp-content/uploads/2019/01/agmr-profile-Walnut-2006.pdf>>
- Brochard, C. E. J. and Cadée, G.C. (2005) Tropische drijfzaden van de Nederlandse kust. *Tabellenserie van de Strandwerkgemeenschap* **30**: 1-66.
- Cadée, G. C. (1996) Tropical drift seeds from the Dutch coast in a wider perspective, palaeontological implications. *Neues Jahrbuch für Geologie und Paläontologie, Abh.* **202**: 183-190.
- Cadée, G. C. (1997) Tropical drift disseminules from the coast of the Netherlands: the human factor. *The Drifting Seed* **3**: 3-4.
- Dong, W., Xu, C., Li, W., Xie, X., Lu, Y., Liu, Y., Jin, X. and Suo, Z. (2017) Phylogenetic resolution in *Juglans* based on complete chloroplast genomes and nuclear DNA sequences. *Frontiers in Plant Science* **8**: 1-13.
- Ebbesmeyer, C. C. (1997) Seagoing black walnut endocarps. *The Drifting Seed* **3**: 8.
- Grimshaw, J. M. (2003) *Juglans*, notes on the temperate species. *International Dendrology Society Yearbook*. Pp 107-130.

- Gunn, C. R. (1968) Stranded seeds and fruits from the southeastern shore of Florida. *Garden Journal* **18**: 43-54.
- Gunn, C. R. and Dennis, J. V. (1999) *World guide to tropical drift seeds and fruits*. Krieger Publishing Company, Malabar, Florida.
- Gunn, C. R., Andrews, J. M. and Paradine, P. J. (1984) Stranded seeds and fruits from the Yucatan Peninsula. *Anales del Instituto de Biología de la Universidad Nacional Autónoma de México. Series Botanica* **53**: 21-60.
- Hartshorn, J. K. (1999) Diamond of California. *The San Joaquin Historian* **8**: 1-9.
- Hemery, G. E., Savill, P. S. and Thakur, A. (2005) Height growth and flushing in common walnut (*Juglans regia* L.): 5-year results from provenance trials in Great Britain. *Forestry* **78**: 121-133.
- Johnson, O. and More, D. (2006) *Collins tree guide*. HarperCollins, London.
- Kerr, G. (1993) Establishment and provenance of Walnut in Britain. *Forestry* **66**: 381-393.
- Manning, W. E. (1957) The genus *Juglans* in Mexico and Central America. *Journal of the Arnold Arboretum* **38**: 121-150.
- Molnar, T. J., Zaurov, D. E., Capik, J. M., Eisenman, S. W., Ford, T., Nikolyyi, L. V. and Reed Funk, C. (2011) Persian Walnuts (*Juglans regia* L.) in Central Asia. *Annual Report of the Northern Nut Growers Association* **101**: 56-69.
- Mu, X.-Y., Sun, M., Yang, P.-F. and Lin, Q.-W. (2017) Unveiling the identity of Wenwan Walnuts and phylogenetic relationships of Asian *Juglans* species using restriction site-associated DNA-sequencing. *Frontiers in Plant Science* **8**: 1-9.
- 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 **Number 10**. Botanical Society of the British Isles, London. 156pp.
- 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.
- Pollegioni, P., Woeste, K. E., Chiocchini, F., Del Lungo, S., Olimpieri, I., Tortolano, V., Clark, J., Hemery, G. E., Mapelli, S. and Malvolti, M. E. (2015) Ancient humans influenced the current spatial genetic structure of Common Walnut populations in Asia. *PLoS One* **10**: e0135980. doi:10.1371/journal.pone.0135980.
- Pollegioni, P., Woeste, K., Chiocchini, F., Del Lungo, S., M., Olimpieri, I., Tortolano, V., Clark, J., Hemery, G. E., Mapelli, S. and Malvolti, M. E. (2017) Rethinking the history of Common Walnut (*Juglans regia* L.) in Europe: its origins and human interactions. *PLoS One* **12**: e0172541.

- Pollegioni, P., Woeste, K. E., Chiocchini, F., Olimpieri, I., Tortolano, V., Clark, J., Hemery, G. E., Mapelli, S. and Malvolti, M. E. (2014) Landscape genetics of Persian Walnut (*Juglans regia* L.) across its Asian range. *Tree Genetics & Genomes* **10**: 1027–1043.
- 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.
- Quigley, D. T. G. and McNamara, L. (2020) A further record of a stranded Jamaican Walnut endocarp *Juglans jamaicensis* C. DC (Juglandaceae: Cardiocaryon) from Irish waters. *Irish Naturalists' Journal* **37**: 49-50.
- Quigley, D. T. G. and Minchin, D. (2019) First record of a stranded Black Walnut *Juglans nigra* L. (Juglandaceae: Cardiocaryon) from Irish waters and a review of NW European records. *Bulletin of the Irish Biogeographical Society* **43**: 123-130.
- Quigley, D. T. G., Minchin, D. and O'Shea, J. (2020) First record of a stranded White Walnut or Butternut (*Juglans cinerea* L.) (Juglandaceae: Cardiocaryon) from Irish waters. *Irish Naturalists' Journal* **37**: 47-49.
- Ridley, H. N. (1930) *Dispersal of plants throughout the world*. Reeve, London. 744pp.
- Smith, A. F. (2020) Historical virtues of the walnut. <<http://andrewfsmith.com/wp-content/themes/wooden-mannequin/pdf/WalnutArticle.pdf>>
- Song, Y.-G., Fragnière, Y., Meng, H.-H., Li, Y., Bétrisey, S., Corrales, A., Manchester, S., Deng, M., Jasińska, A. K., Vãn Sâm, H. and Kozłowski, G. (2020) Global biogeographic synthesis and priority conservation of the relict tree family Juglandaceae. *Journal of Biogeography* **47**: 643-657.
- Sullivan, G. (2004) The University of Texas at Austin Marine Science Institute (UTMSI) Sea-Bean Collection - update. *The Drifting Seed* **10**: 11.
- Taha, N. A. and Al-Wadaan, M. A. (2011) Utility and importance of walnut, *Juglans regia* Linn: a review. *African Journal of Microbiology Research* **5**: 5796-5805.
- Tomás, D. F. (2000) Walnuts (*Juglans regia* L.) in Mediterranean warm climates. Pp. 405-427. In. Erez, A. (Ed.) *Temperate Fruit Crops in Warm Climates*. Springer, Dordrecht. <[https://doi.org/10.1007/978-94-017-3215-4\\_15](https://doi.org/10.1007/978-94-017-3215-4_15)>
- Van der Ham, R. (2012) Bosmuizen picknick. *Papyrus* **3** (Autumn 2012): 5-6.
- Van der Ham, R., Cadée, G. C. and Kruiswijk, W. (2013) Walnoten, pecannoten en een vleugelnoot van de Nederlandse kust. *Het Zeepaard* **73**: 96-103.
- Van der Ham, R., Eurlings, M. and Van Den Wollenberg, B. (2014) Het walnootassortiment van de Botanische Tuin. *Papyrus* **1** (Spring 2014): 14-16.

- Vischi, M., Chiabà, C., Raranciuc, S., Poggetti, L., Messina, R., Ermacora, P., Cipriani, G., Paffetti, D., Vettori, C. and Testolin, R. (2017) Genetic Diversity of Walnut (*Juglans regia* L.) in the Eastern Italian Alps. *Forests* **8**: 81. <<https://doi.org/10.3390/f8030081>>
- Wani, M. S., Hussan, A., Ganie, S. A., Munshi, A. H., Lal, E. P and Gupta, R. C. (2016) *Juglans regia*- a review. *International Journal of Latest Research in Science and Technology* **5**: 90-97.
- Wani, M. S., Lone, A. H., Yaqoob, U., Munshi, A. H., Wani, A. M. and Ganie, S. A. (2014) Effect of altitude on the morpho-phenological parameters of *Juglans regia* L. from different sites of Kashmir Himalaya. *International Journal of Advanced Research* **2**: 97-110.
- Zhang, B.-W., Lin-Lin, X., Li, N., Yan, P.-C., Jiang, X.-H., Woeste, K. E., Lin, K., Renner, S. S., Zhang, D.-Y. and Bai, W.-N. (2019) Phylogenomics reveals an ancient hybrid origin of the Persian walnut. *Molecular Biology and Evolution* **36**: 2451-2461.
- Zucchelli, C. (2016) *Sacred trees of Ireland*. Collins Press, Cork.





**PLATE 1.** General views of Saint Maelruan's Persian Walnut Tree (*Juglans regia*) in the grounds of Saint Mary's Priory, Tallaght, Dublin, Ireland, 2 July 2019. Photographs © D. T. G. Quigley.



**PLATE 2.** General views of Saint Maelruan's Persian Walnut Tree (*Juglans regia*) in the grounds of Saint Mary's Priory, Tallaght, Dublin, Ireland, 2 July 2019. Photographs © D. T. G. Quigley.



**PLATE 3.** The fruit of Saint Maelruan's Persian Walnut Tree (*Juglans regia*) in the grounds of Saint Mary's Priory, Tallaght, Dublin, Ireland, 2 July 2019. Photographs © D. T. G. Quigley. Top: Walnut fruits. Bottom: Predated walnut fruits and nuts.



**PLATE 4.** Persian Walnut (*Juglans regia*). Left: Fanore Beach, Fanore Mor, County Clare, 13 September 2017. Right: Goilin, Carrowwntedaun, Lahinch, County Clare 9 March 2019. Photographs © Liam McNamara.



**PLATE 5.** Persian Walnuts (*Juglans regia*) from County Clare. Left: apical view. Middle: lateral view. Right: basal view. Photographs © Liam McNamara.