

Henry — The Tree Breeder¹

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Dr. Augustine Henry joined the Chinese Imperial Maritime Custom Service in 1881 and spent two tours of duty in China between 1881 and 1900. (Morley 1979). His interest in forestry, which had commenced during his years in China finally blossomed in the winter of 1901/02 following a meeting he had with Prof. Schlick, the well-known German forestry expert. His desire to follow a forestry course stemmed from his wish to do something worthwhile for Ireland. At this stage of his life he was 45 years of age. Undeterred by the diversity of the subject he plunged straight into it with all the enthusiasm he had shown during his years collecting botanical specimens in China. He soon found the study difficult mainly on account of the language problem as most of the lectures were in French. However it was the field work which really excited him. He saw, how, with modern cultivation techniques, the potential of forestry could be developed. He became aware of the importance of choosing the correct species for the site conditions and not the haphazard planting of species which had been carried out at Knockboy in the late 19th century. The value of trees other than as a source of lumber was also clearly demonstrated in the Alps where they were used as soil stabilizers and as preventors of avalanches and landslides. He took particular note of species which grew on bogs as he felt that such areas would have the greatest potential for afforestation in Ireland (Pimm 1966). As a positive move in this direction he forwarded seed of American larch (*L. occidentalis*) to his brother for growing on peats in Ireland. This early awareness of the importance of ecology was to permeate all his writings in later years.

His work on "Trees of Great Britain and Ireland" demonstrated clearly that it was a mistake to base both Irish and English forestry on purely European species. He found that European summers

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were hot and dry while winters were hard. In contrast western north America, with its vast reservoir of species, had climate conditions similar to those found along the western seaboard of the British Isles. His expedition to North America in 1905 brought these facts home forcibly to him. He was instrumental in obtaining seed of Western Larch (*L. occidentalis*) during this trip but was disappointed in the quality of stems from which it was collected. In 1906 he was able to put his expertise at the disposal of the Government when he made his deposition to the Departmental Committee on Forestry (Anon. 1908). Henry's main interest was in the species that should be planted. Many of the experts preferred hardwoods but he came out strongly in favour of conifers, as broadleaved species were a long term investment. He urged them to try out species from countries with mild damp climates such as Douglas fir, Sitka spruce, Scots pine and Sequoia. At all times during his presentation he stressed that the trees must be appropriate to the climate. Subsequent events in Irish forestry have shown how right he was in his choice.

The preparation of the "Trees" had a constant stimulating effect on him. In the course of the preparation of the section on elms (*Ulmus*) he was puzzled how best to classify the numerous varieties of the species. With his usual enthusiasm he investigated the ancestry of as many varieties as possible of the species. In 1909 he sowed ninety different seed lots collected in various locations in the south of England. His first conclusion was that there were only two pure species *U. montana* and *U. glabra*. This conclusion was based on his observations of the growth habit of the seedlings raised in boxes. All seedlings of both *U. montana* and *U. glabra* were uniform in size and in other characteristics. Every other kind of elm when sown produced seedlings which were different in size and arrangement of leaves. When he sowed the seed of the Huntingdon elm, first recorded as a seedling in 1746/56, he found that the progeny segregated out in the Mendelian ratio of 3:1 when leaf arrangement was examined, — 732 seedlings with opposite leaves and 239 with alternate leaves. When a second characteristic was entered into classification the seedlings segregated out into a 9:3:3:1 ratio (small opposite leaves : large opposite : small alternate : large alternate). He came to the conclusion as a result of this study that the Huntingdon elm was a hybrid between *U. montana* and *U. glabra*. He also pointed out that like most first crosses the Huntingdon elm lent more to one parent than the other. When he examined the seed boxes of the "English elm" he found that none had germinated. On further examination of the parents many were found to have malformed flowers. He had no doubt that were it not for its ability to produce suckers the English Elm would have long since

disappeared. A further conclusion he drew from this study was that varieties were often simple Mendelian combinations of two existing species. Where only one species occurred no varieties of the kind so common to elms were present. He instanced beech (*F. sylvatica*) where all varieties can be classified as sports arising from some malformation or misdirection of growth in the individual plant e.g. copper beech, variegated beech. A similar situation exists for ash. (Henry 1910).

Henry was of the opinion that the variation within oaks was similar to that in the elm. where the number of species was large there was a correspondent increase in the number of varieties. This was particularly so in southern Europe where no less than 35 varieties of *Q. Ilex* occur. The position within the oaks was typified by the Lucombe oak which originated as a result of crossing Turkey oak (*Q. cerris*) by Cork oak (*Q. suber*) in 1768. The hybrid was found to be intermediate between both parents, being subevergreen. When seedlings of the Lucombe oak were raised a variety of forms developed, bearing a strong resemblance to what Henry had discovered with elms.

These investigations indicated to him the value of hybrids. He saw that the only hope for forestry was in the growing of timber rapidly. This could be achieved not only by the introduction of fast growing species but also by hybridisation for non-coniferous species. His awareness of the value of tree improvement can be gauged from the statement in his paper to the Linnean Society in 1910 when he advocated the use of tree breeding methods for the improvement of forest trees similar to that used by farmers and gardeners for centuries (Henry 1910).

While at Cambridge he continued to work on the "Trees" and by 1913, with the publication of the last volume, this mammoth task had been completed (Elwes and Henry 1913). In the same year he resigned his post at Cambridge and took up the first Chair of Forestry at Dublin. This appointment re-awakened his keen interest in Irish forestry. In a lecture to the Irish Forestry Society in October 1913 he again stressed the need for the correct choice of species. When he said "On the wise choice of trees for planting depends the continued success of the afforestation movement". However choice of correct species alone was not sufficient for success. Both Douglas fir and Sitka spruce have large distributions and on account of such require special study. His was the first pronouncement on the importance of correct provenance choice for Irish forestry. In relation to Douglas fir he stated that the coastal origins were superior in vigour to those growing in the mountains far inland. Furthermore, individuals of northern stations are not

so vigorous as those of southern stations. He proposed that "it might be worthwhile to establish, with the aid of the Governments of British Columbia and Washington State, seed collection stations under the supervision of a trained forester. The localities where vigour and good form of the different trees exist with considerable exposure to wind would serve as collection grounds for the seed to be used in raising plants for similar stations in Ireland. Of Sitka spruce he said that "with such a history no tree seems better adapted to the worst sites in our afforestation areas" (Henry 1913).

Hybridisation of species as a means of increasing production was always of great interest to Dr. Henry. Not satisfied with advocating their use he also took an active part in the production of new hybrids. His main object in this work was to show that novel and valuable trees could be artificially made, particularly with hardwood species. He recognised that the growth of pure species was so slow as to require long periods for their maturity and without vigorous crosses the most valuable classes of timber can only be grown in limited quantities. There was also the hope that immunity to disease might be increased by first crosses. As his work with elms had shown that "first crosses do not come true from seed" it was important that they could be reproduced vegetatively. This could be achieved by cuttings in the case of poplars and elms or by grafting where rooting was a problem. He attempted to ascertain the cause of hybrid vigour with the aid of Miss Marshall of T.C.D. She examined the growing points hybrid poplars and their parent species but could find no difference in size or chromosome number. He postulated the theory that it may be due to some enzyme and proposed that the enzymes of hybrids be injected into growing points of parent species to see if this would stimulate growth. Another possibility was the closeness of the relationship between the parent species. He discounted this latter theory as the hybrid $x P. generosa$ was derived from two unrelated parents. The problem of creating hybrids was brought home forcibly to him in 1914 when flowers of *Juglans regia* which he had pollinated with pollen of *Juglans nigra* were killed by late spring frost. He also saw difficulty in obtaining pollen of suitable exotic species and it was for this reason that he proposed that much of this work should be carried out in more southerly stations. Nevertheless he pressed on with his own work in this field. In 1912 he pollinated *P. angulata* (*P. deltoides*) from Carolina with pollen of *P. trichocarpa* which produced four seedlings of excellent vigour. By the end of 1913 they had reached 1.1m in height growth and at age 7 years 11.3m tall. The hybrid was intermediate between parents with regard to width and colour of leaves. He named the hybrid $x P. generosa$. Though it was

remarkably rapid in growth it was not a commercial success because of its susceptibility to disease. Its main value today lies in its historical value as it was the first cross between a black and a balsam poplar (Henry 1914a).

On the same day he crossed *P. angulata* (*P. deltoides*) x *P. nigra betuifolia*, which yielded 7 seedlings. These were not as vigorous as the previous cross. Though it is not named, the hybrid is probably x *P. vernirubens*. He favoured working with poplars because they yielded seed within one year which allowed rapid evaluation of their merit. The genus *Fraxinus* was another genus which he felt could yield valuable hybrids. In 1912 he crossed *F. oregona* with *F. lanceolata*. This cross yielded twelve seedlings all of which were considered to be vigorous. The cross *F. oregona* x *F. excelsior* yielded no seed. *F. excelsior* x *F. americana* yielded five seedlings two of which were vigorous and three were weak. Unfortunately no record is available of their further development. All of the ash crosses were carried out at Kew.

A third genus with which Henry worked was that of *Alnus*. This was undertaken at Cambridge Botanic Gardens in 1911. In all four species were used in this work (1) *A. cordata* (2) *A. glutinosa* var *japonica* (3) *A. incana* and (4) *A. glutinosa europaea*. The yield of viable seedlings and their subsequent vigour depended on the parents. Of the crosses attempted only *A. cordata* x *A. incana* yielded progeny of interest. It was the first occasion on which this hybrid had been produced naturally or artificially as the five species do not grow together. In all instances yield of seedlings was low due either to late bagging or selfing. In the same year crosses were attempted within the genera *Ulmus* and *Larix*. With both genera, yield of seedlings was poor and no hybrid vigour was recorded. The *Fraxinus* crosses were repeated in 1913 at Kew but no record is available of their success. His work on hybridisation did not end when he moved to Dublin. In 1914 he was instrumental in having a number of crosses carried out at Avondale within a number of genera these being *Larix*, *Cupressus*, *Fraxinus*, *Fagus* and *Quercus*. Fruits were set but unfortunately no records exist to state if these crosses yielded viable seed (Henry 1914b).

Many natural hybrids have occurred in gardens and aboreta, when geographically distinct species are planted side by side. In the early part of the present century many such hybrids among broadleaves were recognised. Among conifers they were less frequent. Henry was one of the first to recognise that they could also occur in the coniferae when he wrote on the origins of *Larix pendula* (Henry 1916a). Delving into the history of planting at Peckham, where it was first recognised, Henry came to the conclusion that

it was a hybrid between *L. decidua* and *L. americana* (*L. laricina*) Bean 1950). The latter species had been introduced by Peter Collinson in the late 18th century. This particular hybrid was of no commercial value because of its lack of vigour. Seeds raised in Russia from *L. pendula* exhibited bizarre, prostrate and pendulous forms. Henry was of the opinion that these were the results of mutation as a result of hybridity. In the course of his work with *L. pendula* he came to the conclusion that *L. Marschlini* was also a hybrid. The tree was first seen in the forest of Igis, Switzerland having been raised from seed collected from a *L. leptolepis*. Though not proven conclusively Dr. Henry was of the opinion that the male parent was *L. sibirica* (Henry 1915b).

His interest in hybrids was rewarded in 1919 when he positively identified the Dunkeld larch as being a hybrid between *L. leptolepis* and *L. decidua*. He used material supplied by Mr. Murray at Murthly and by Mr. Kerr at Dunkeld. His examination included both the macroscopic and microscope features of the possible hybrid. He saw a great future for this particular hybrid as "all known hybrids were remarkable for their great vigour and good health". In recognition of his work in the identification of this hybrid it bears his name *L. eurolepis*, *A Henry*. (Henry and Flood 1919b).

Throughout the "Trees of Great Britain and Ireland" there is constant reference to hybrids within each of the genera. Henry was not able to investigate all of these or to examine their history. One species, however, received his full attention, the species being *Plantanus acerifolia*, the London Plane. He was, originally of the opinion that it was not of hybrid origin. This opinion was to be changed in his paper on the history of the London plane. The occidental plane (*P. occidentalis*) was introduced to England in 1636 approximately a century after the oriental plane (*P. orientalis*). This first record of a hybrid between the two species was made in 1700 by Plukenet at Oxford Botanic Gardens. As a result of these historical delvings he came to the conclusion that the species *P. acerifolia* was in fact a hybrid (Henry and Flood 1919a).

When speaking of commercial forestry Dr. Henry was always aware of the importance of the choice of the correct species and of the correct seed origin. This is clearly demonstrated in his submission to the 1908 Interdepartmental Commission on Forestry. He returned to the same theme in his paper on Douglas fir published in 1920 when he stated that the importance of a comparative study of *Pseudotsuga menziesii* and *Pseudotsuga glauca* is unquestionable. To prove his point he quoted Schlich as stating that Oregon Douglas fir at 12 years produce 1176 cubic ft/acre compared

with 206 cu.ft/acre for Colorado Douglas fir. Reference is also made to the susceptibility of the various species in this genus to frost exposure and unsuitable soil types (Henry and Flood 1920). A further genus in which he had taken a keen interest was that of *Larix*. In 1908 he advocated the use of *L. occidentalis* for peat sites and stated that he had carried out a collection in Montana and Idaho of seed of this species. The results of this collection and a further one in 1908 are reported in his paper on cultivation of Western larch. Growth was generally poor on a wide variety of site types and in addition mortality was high (Henry 1922).

His foresight and knowledge in tree breeding have long since been widely recognised. It is to be regretted that his pronouncement on choice of correct seed source for exotic species was not heeded more widely. If they had, many of the problems associated with incorrect choice would not have occurred, both in Ireland and world wide. Ernst J. Schreiner the famous American geneticist most aptly summed up his work when he stated "Augustine Henry was the first forester to realise the possibility of creating better forest trees by scientific breeding and he was the first forester to do something about it" (Schreiner 1949).

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