

# 'Broken' tulips and Tulip breaking virus



▲ Illustration of 'Tulip cv. Semper Augustus' taken from *The Tulip Book* (circa 1630–1639). *Netherlands Economic History Archive*

► 'Broken' tulips, yellow and pink roses in a glass vase on a stone ledge, with a bottle of ink and a piece of paper identifying the tulips, by Jan Phillip van Thielen (1645–1650). *Reproduced with the permission of Richard Green Galleries*

**D**ue to their beauty, range of colours and early flowering, tulips have remained popular as garden plants and cut blooms since they were first imported into Europe from Asia Minor and Persia more than four and a half centuries ago. Their introduction is usually attributed to Ogier de Busbecque who, in 1554, first sent tulip bulbs and seeds to Vienna. This, of course, was only a few years after the deaths of great historical figures such as Henry VIII, Martin Luther, Pope Clement VII and Francis I of France, and when Tsar Ivan IV (Ivan the Terrible) was at his most powerful. It is interesting that Busbecque, Ambassador of Ferdinand I, the Holy Roman Emperor, to the great Sultan Souleiman, the Ottoman Emperor (known to Europeans as the Magnificent and to his subjects as the Lawgiver), considered in such turbulent times the collection of plants new to the western world an important duty. After their introduction, tulips were immediately

popular in Europe and, soon after, bulbs were distributed from Vienna to Augsburg, Antwerp and Amsterdam, and subsequently to other European cities.

## *Tulip breaking virus*

Of the viruses now known to infect tulips and cause 'breaking', the best known is *Tulip breaking virus* (TBV) which induces leaf chlorosis and, in coloured cultivars, 'broken' flowers. Breaking, or rectification as it was also earlier known, describes the appearance of the flowers in which the petals, instead of being uniformly coloured, are variegated due to the irregular distribution of anthocyanin. Such 'broken' flowers are known to have occurred in tulips in Europe within a decade or so of their introduction and have since featured commonly in art and history. As early as 1585 Carolus Clusius, Professor of Botany in Leiden, described how some red-, yellow- and purple-flowered tulips in subsequent years produced flowers that became variegated (or, as later described,



It's hard to believe that in the 17th century people yearned to possess a diseased flowering bulb. Yet as **Alan Brunt** and **John Walsh** describe, tulips with variegated petals due a virus infection once commanded higher prices than works of art.





▲ Illustrations of 'Tulip cv. de geele Admiral de Man' (top) and 'Tulip cv. Candida' (bottom) taken from *The Tulip Book* (circa 1630–1639). *Netherlands Economic History Archive*

▶ Electron micrograph of potyvirus particles. *Colin Clay, Warwick HRI*

'broken'). The cause of breaking was then unknown and, not surprisingly in the absence of knowledge, was attributed to various causes, including an unsuitable planting depth for bulbs, applications of manure that were too high or too low, a soil that was too poor or too rich, or an inclement climate. Broken flowers produced by tulips in the year or two after becoming infected are undoubtedly beautiful, but thereafter the vigour and flower quality of infected plants decline markedly. Clusius first observed in 1585 that such plants slowly degenerated and this is well expressed, if rather grandiloquently, in his words '...any tulip thus changing its original colour is usually ruined afterwards and so wanted only to delight its master's eyes with this variety of colours before dying, as if to bid him a last farewell'. However, in the 20th century TBV was described occasionally as 'the benevolent virus', probably due to an inadequate literature search by the authors!

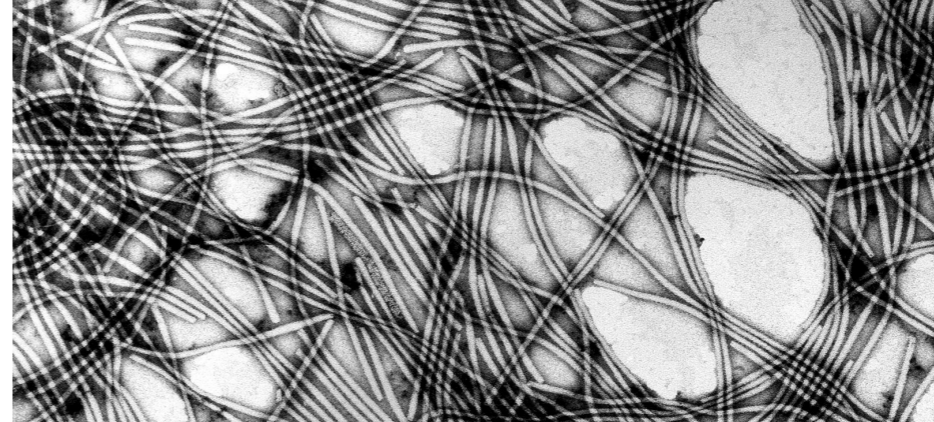
### Tulip speculation in Holland

Although infected bulbs gradually degenerated, those producing broken flowers were very desirable and often sold for high prices, especially during the early 17th century. Financial speculation in such bulbs was then common; for example, some bulbs of cv. Semper Augustus, the most beautiful of broken red-flowered tulips, were each sold in Holland for 1,000 florins in 1623 when the average annual income was 150 florins. Two years later, each good Semper Augustus bulb sold for 2,400 florins, and in 1633 each bulb was valued at 5,500 florins. Speculation in tulips reached its peak from 1634 to 1637, and the

mania is reported as affecting not only the wealthy, but also other citizens, including bricklayers, plumbers, swineherds, clergymen and teachers. The history of this period has been told repeatedly, but is worth restating briefly. In 1637, the year of so-called 'tulipomania', it is recorded that a bulb of Semper Augustus sold for 10,000 florins, this amount was then the price of a house, gardens and coach house in a very desirable location near the canal in central Amsterdam. However, this was also the year in which there were more sellers than buyers and eventually the market in tulips collapsed.

There are numerous contemporary satirical poems, essays, cartoons and paintings on the follies of the tulip speculators. As early as 1614 fun was made of those spending large sums on tulips; 'a fool and his money is soon parted' appears on an engraving of two tulips by Claes Jansz, and in a painting by Jan Breughel the Younger, monkeys in contemporary clothing are depicted dealing in tulips. In a classic cartoon, tulip speculators are seen within an inn (which is in the shape of a fool's cap) named 'At the Sign of the Fool's Bulbs' and, as a symbol of stupidity, has outside Flora sitting on a donkey. The cartoon has the caption 'A picture of the wonderful year 1637 when one fool hatched another and the idle rich lost their wealth and the wise lost their senses'. A pamphleteer also satirically valued a tulip bulb as being equivalent to:

|                    |                     |
|--------------------|---------------------|
| 12 fat sheep       | 1 silver goblet     |
| 8 fat pigs         | 1 full dress suit   |
| 4 fat oxen         | 1 bed (with linen)  |
| 8 tons of rye      | 2 hogsheads of wine |
| 4 tons of wheat    | 4 barrels of beer   |
| 1,000 lb of cheese | 2 barrels of butter |



*In 1637, the year of 'tulipomania', it is recorded that a bulb sold for 10,000 florins, the price of a desirable house and gardens in central Amsterdam*

It is also recounted that the Professor of Botany at Leiden (a successor to Clusius) developed such an intense hatred of tulips that he demolished any he saw with his walking cane.

### Tulips in still life paintings

Due to the very high value of bulbs in the early 17th century, it cost less for some citizens to commission Dutch and Flemish artists to paint still life pictures which mainly featured broken tulips rather than buy bulbs. Paintings by Maria van Oosterwyck, Simon Verelst, Ambrosius Bosschaert, Jan Brueghel, Brussel, Hans Bollongier and many other artists are now exhibited in art galleries and museums worldwide. Pictures of 'broken' tulips were also commonly printed in herbals such as *Hortus Floridas*, engraved by C. van de Passe in 1614, which contains one of the earliest known illustrations of these flowers.

TBV was long thought from pictorial records to be the earliest recorded plant virus. However, it is now generally thought that the earliest reference to a virus-induced leaf chlorosis is described in a poem by the Japanese Empress Koken in AD 752: 'For, the plant I saw in the field of summer the colour of the leaves were yellowing'. It is speculated that the described disease was possibly caused by *Tobacco leaf curl virus*, which is known to occur and cause similar symptoms in infected plants in Japan.

### Recent history

Although 'broken' tulips have occurred in Europe for over four centuries, the cause of breaking was not established unequivocally until almost 50 years ago. Immediately after the end of World War I, breaking was thought to be virus-

induced by analogy with other plant diseases; some evidence for this was produced during the following decade when in 1927 it was shown to be sap-transmissible (although in the early 1600s it was shown that breaking could be transmitted mechanically by 'grafting' half a healthy bulb to half a broken tulip bulb) and in 1928 to be transmitted by aphids. It was not until the 1960s that TBV was shown to have flexuous filamentous particles mostly measuring about 12 × 750 nm and thus to be a virus. The genetic code of TBV has now been partially sequenced and the virus is recognized as a member of the genus *Potyvirus* (family *Potyviridae*). Like other members of the genus it is now readily detected and identified by serological and molecular techniques. Today broken tulips can be purchased that are the result of plant breeding, not virus infection. As TBV-infected bulbs gradually degenerate, this can be minimized by removing and destroying 'broken' bulbs quickly before aphids spread the virus to other bulbs and other hosts such as lilies.

### Alan Brunt

Associate Professor of Warwick University, Warwick HRI, Wellesbourne, Warwick CV35 9EF, UK (t 01903 785684; f 01903 785684; e alan.brunt2@btinternet.com)

### John Walsh

Research leader at Warwick HRI and Head of Virus–Vegetable Interactions Group, Warwick HRI, Wellesbourne, Warwick CV35 9EF, UK (t 024 765 75028; f 024 765 74500; e john.walsh@warwick.ac.uk)

### Further reading

- Blunt, W. (1950). *Tulipomania*. London: Penguin.
- Pavord, A. (2000). *The Tulip*. London: Bloomsbury.

### Useful contact

The Wakefield and North of England Tulip Society is dedicated to keeping older cultivars going, and breeding and showing new varieties. For further information contact Mr J.L. Akers, 70 Wrenthorpe Lane, Wrenthorpe, Wakefield WF2 0PT, UK (t 01924 375843).