

Centre of origin and the *Bt* brinjal controversy

The probability of crop-to-wild gene flow depends on the geographic distribution of crops and their wild relatives¹. In this context, caution has been advised in relation to the release of transgenic crops into their centres of origin, i.e. the geographical regions in which they were domesticated, and where wild relatives and/or weedy forms persist. In countries with high plant biodiversity like India, where almost 400 species of crop wild relatives are found, this is a relevant approach. The Indo-Burma zone², or the Indian subcontinent itself³ are regions in which the brinjal eggplant, *Solanum melongena* L., may have originated. Other parts of Asia have also been suggested as candidate areas⁴, and the precise centre of origin remains in question.

However, within the *Bt* brinjal controversy the importance of the centre of origin is not so much its precise location, as the contention that brinjal wild relatives can be expected to occur there. Indeed, in India there are over 20 wild (as well as weedy or introduced) *Solanum* species which, along with *S. melongena*, are members of subgenus *Leptostemonum* (Dunal) Bitter, the 'spiny solanums'. Several of these are crossable with brinjal under experimental conditions⁵, and interspecific hybrids are therefore a possibility in the wild. Hybrids which may arise as a result of crosses between *Bt* brinjal and the wild relatives could develop extreme weediness or invasiveness, thus disrupting ecological balance.

Wild relatives of brinjal include its putative progenitor, *S. incanum* L., whose Saharo-Sindian distribution covers north-east Africa and the Middle East⁶, as well as Pakistan⁷ and parts of India⁸. There have been varying views on the presence of *S. incanum* in India, and several workers in the western hemisphere have considered the eastern part of its range to be limited to Iran^{2,6,9}. However, collections in some herbaria (e.g. Kew) from Pakistan and northwest India comprise specimens which clearly conform to the neotype of *S. incanum* L., as elected by Hepper and Jaeger¹⁰. In any case, the centre (of distribution) of *S. incanum*

cannot therefore be specified as Africa, as suggested by recent authors⁴. Some discrepancy may have arisen around the relationship between *S. incanum* and the allied taxa *S. campylacanthum* A. Rich. subsp. *Campylacanthum* Samuels, *S. campylacanthum* subsp. *panduriforme* (Dunal) Samuels and *S. lichtensteinii* Willd., which have distributions limited to eastern and southern Africa¹¹. In addition, all three species are believed to have evolved from a common ancestor in eastern Africa¹¹. Furthermore, there have been past difficulties over the taxonomic distinction between *S. incanum* and these close relatives. As a consequence, all three species are sometimes grouped together as the species aggregate *S. incanum sensu lato*, causing additional confusion.

As discussed recently by Hanur⁴, a theory had suggested that the wild progenitor of brinjal was to be found in the savannah habitats of Indo-China⁶. At that time there was no evidence of its existence, but it was subsequently proposed¹² that *S. cumingii* Dunal, from southeast Asia, may be the elusive missing ancestor, and may itself have evolved from *S. incanum*. The presence of an ancestral form in Southeast Asia tallied with the premise held at the time, that primitive *S. melongena* cultivars were limited to this region. However, the precise taxonomic affinities of *S. cumingii* remain in question¹³. Another hypothesis purports that the missing wild ancestor may have been discovered in southern India late last century⁶, although it is likely that the collected samples were of hybrid origin. These alternative theories were based on studies performed over 20 years ago, when information on *S. incanum* and *S. melongena* landraces was limited.

Molecular analyses have demonstrated that there is strong similarity between *S. melongena* and *S. incanum*^{9,14}, conforming to the general consensus that brinjal originated from *S. incanum*. Updated distribution information on *S. incanum* depicts a typically Saharo-Sindian pattern whereby, if India were deemed to be the centre of origin of brinjal, then

future studies into ancient landraces in the northwest of the country might provide fruitful information on domestication events.

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