Engineering fig (*Ficus carica* L.) as a new fresh fruit crop

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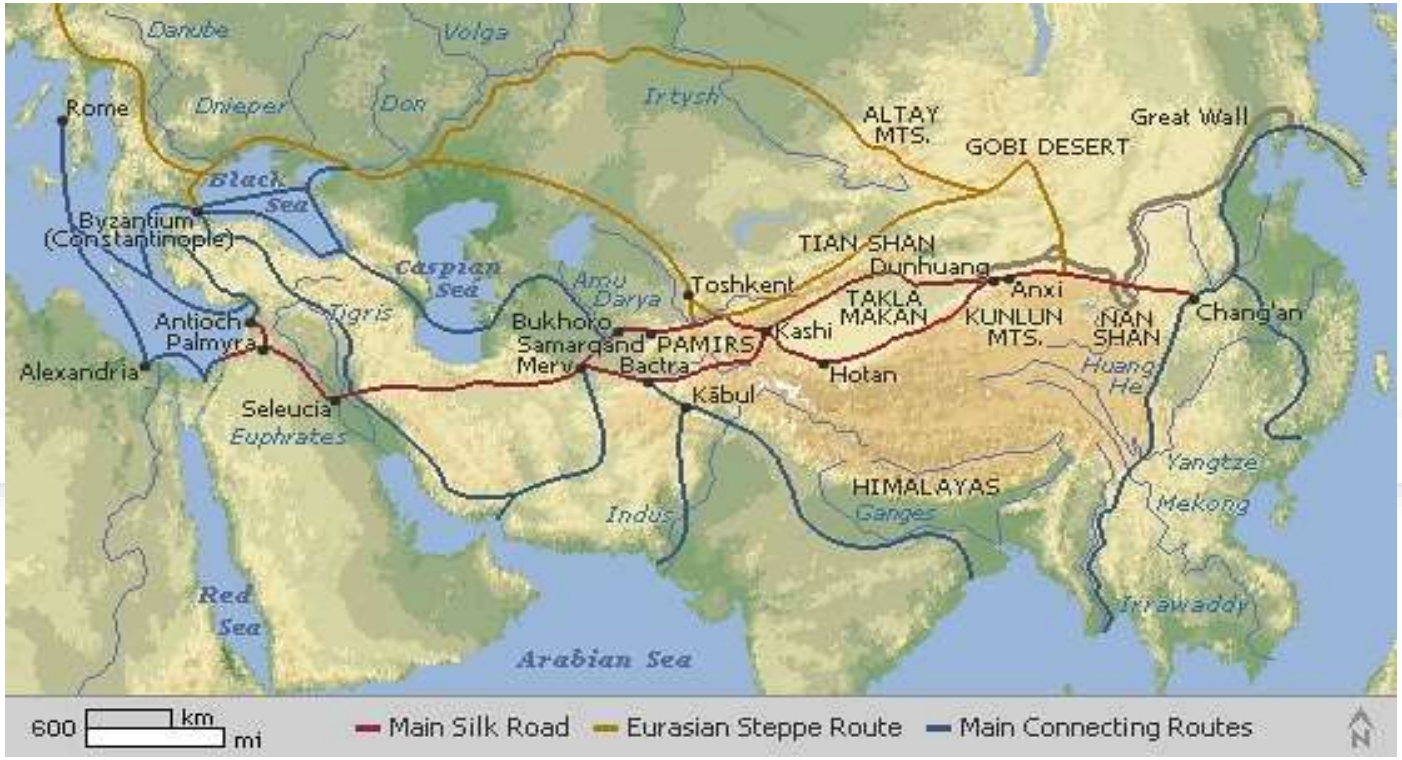
A Brief Review of Fig Domestication and Selection



Figs were domesticated and selected in West Asia and the Mediterranean region

A Brief Review of Fig Domestication and Selection

Figs can naturally dried on the tree, which is favourable in dry fig cultivar selection.

Selection of fresh consumption varieties or dual-purpose varieties for both drying and fresh consumption.

Re-domestication
of figs targeting
fresh consumption

To increase the market share of figs in the fresh fruit market and the value of fig production

- Fruit ripening and harvest efficiency
- Fruit storability
- Tree structure, leaf size and shape (yield)
- Latex

Fruit storability and Shelf-Life

- The bottle neck in fresh fig cultivation acreage increase and the development of the fresh fig industry
- Key factor in fresh fig's physical availability
- Cost saving in highly expensive cold chain transportation.

Tree structure, leaf size and shape

- Tree size reduction (height, width)
- Leaf size - shoot density - yield amount
- Lateral shoots impact orchard management efficiency

Fruit ripening and harvesting efficiency

Other important fruit characteristics

- Size
- Internal cavity
- Pulp color
- Peel color
- Stalk length
- Cracking
- Flavor

Re-domestication Roadmap for Fresh Fig Varieties

I. Collation of germplasm resources (*Ficus carica* L. and close species, collection, study, using)

II. Regulatory mechanism analysis of key traits and developing molecular markers

III. Strengthen breeding practices and improve breeding efficiency

IV. International collaboration

Fig Genome Sequencing

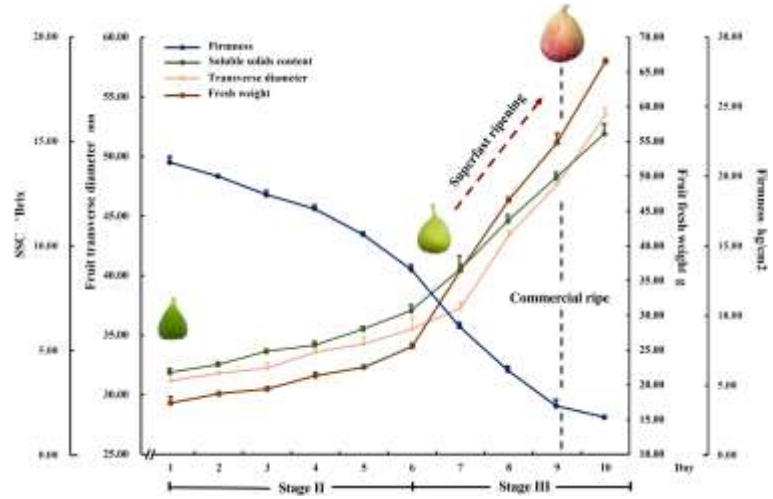
- ✓ Green Peel cultivar T2T genome
- ✓ Male fig cultivar T2T genome
- ✓ Resequencing fig cultivars and wild types
- ✓ Genome-Wide Association Studies (GWAS)

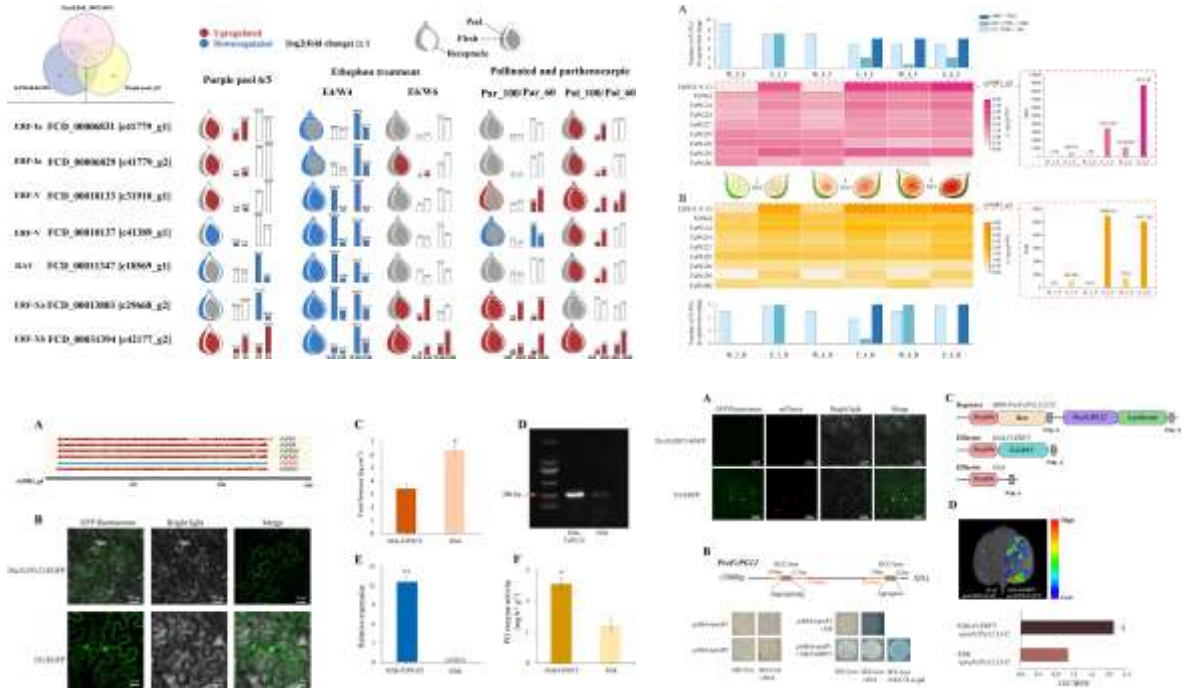
Summary statistics	**Green Peel**	**Dottato** Usai G et al. 2020	**Horaishi** Mori K et al. 2017
No of sequences in contig level	210	905	27,995
Total size (bp)	306,827,183	333,400,567	247,090,738
Longest sequence (bp)	16,435,380	5,010,936	1,764,766
Shortest sequence (bp)	2000	20,012	479
No of sequences >1Mb	69 (32.85%)	81 (9.0%)	8 (0.0%)
N sequence content (%)	0.00	0.00	14.72
Contig N50 length (bp)	5,770,866	823,517	166,092
BUSCO assessment (%)	98.1	93.3	90.5
No of sequences in chromosome level	99	511	NA
Chromosome-level assembly size (bp)	298,696,503	266,561,963	NA
Anchor rate (%)	97.35%	79.95%	NA
LAI	18.14	15.27	NA
Protein coding genes (No.)	27,251	37,840	36,138
Average gene length (bp)	3,600	2460	2115
Average coding sequence length (bp)	1,168	956	952
Average exon number per gene	6.10	4.56	NA
TE proportion (%)	36.56	33	16

Regulatory mechanism analysis of key traits and developing molecular markers

Regulation Mechanism of Fig Fruit Softening

- ERF transcription factors
- Polygalacturonase gene

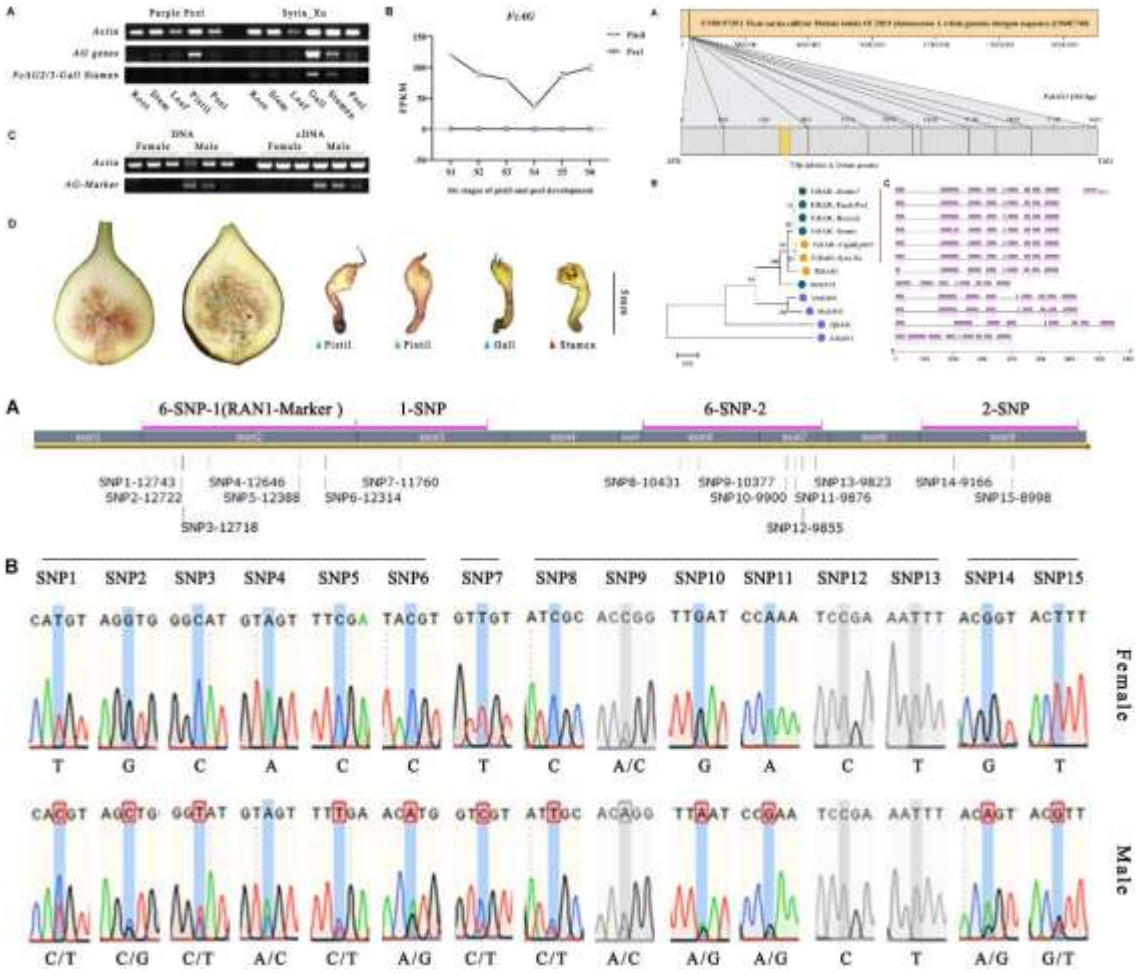




1. Cui, Y., Zhai, Y., He, J., Song, M., Flaishman, M.A and Ma, H. (2022) AP2/ERF genes associated with superfast fig (*Ficus carica* L.) fruit ripening. Frontiers in Plant Science. 13:1040796.
2. Wang, Y., Fan, Z., Zhai, Y., Huang, H., Vainstein, A and Ma, H. (2023) Polygalacturonase gene family analysis identifies *FcPG12* as a key player in fig (*Ficus carica* L.) fruit softening. BMC Plant Biology. 23: 320.

Regulatory mechanism analysis of key traits and developing molecular markers

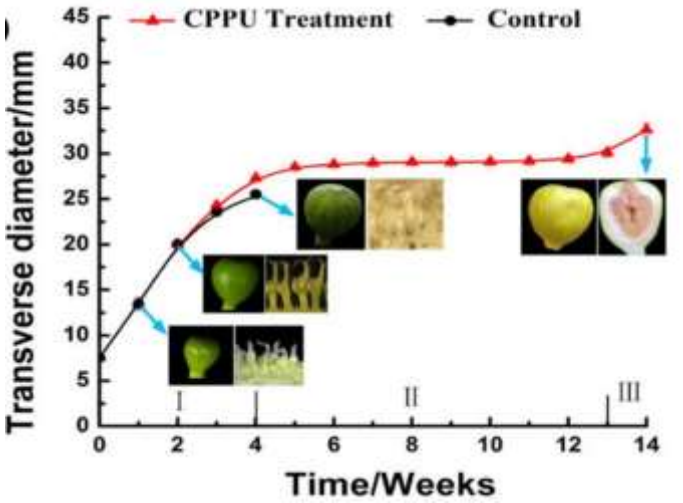
Develop Markers for Fig Male and Female Identification



Wang, X., Song, M., Flaishman, M.A, Chen, S and Ma, H. (2021) *AGAMOUS* Gene as a new sex-identification marker in fig (*Ficus carica* L.) is more efficient than *RAN1*. Frontiers in Plant Science. 12:755358.

Strengthen breeding practices and improve breeding efficiency

- Inducing pollen production in male fruits
- Selecting fig cultivars for China
  - Tolerant to lower light conditions
  - Tolerant to simultaneous rainy and hot weather conditions
  - Tolerant to lower winter temperature
  - Resistant to major pests like beetles and weevils



曾随神舟飞天 全球首批太空育种无花果苗在威远开始移栽

3月9日，首批2000株太空育种无花果果苗成功移栽被栽种到四川远歌农业集团有限公司内江市威远县无花果产业融合发展示范园的土壤中。现场参与栽植的人员，两人一组。干劲十足，每一道工序都做得十分认真，相互协作栽下无花果航天育种苗。

The Stone Age didn't end because they ran out of stones





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