6° BACSA INTERNATIONAL CONFERENCE
"Building Value Chains in Sericulture"

Artificial diet as a tool to obtain new silkworm hybrid constitution

The starting point:

- CRA-API's germplasm collection of about 200 strains
- Strains differ in:
  - Phenotype
  - Physiology
  - Nutritional efficiency
  - Adaptability to artificial diet

- Selection based on nutritional efficiency and productivity

- Ten strains tested for productivity in 2 preliminary experiments (cocoon and shell weights)

- Selection of 4 strains for more in-depth analysis (namely strains n°118, 120, 124, 129 according to collection number)

- Analysis carried out on both mulberry leaves and artificial diet

Experiments on mulberry leaves

- Rearing until the beginning of Vth instar as a mass according to standard methods

I-IV

Vth instar
(25 larvae)

Vth instar
(25 larvae)

Vth instar
(25 larvae)
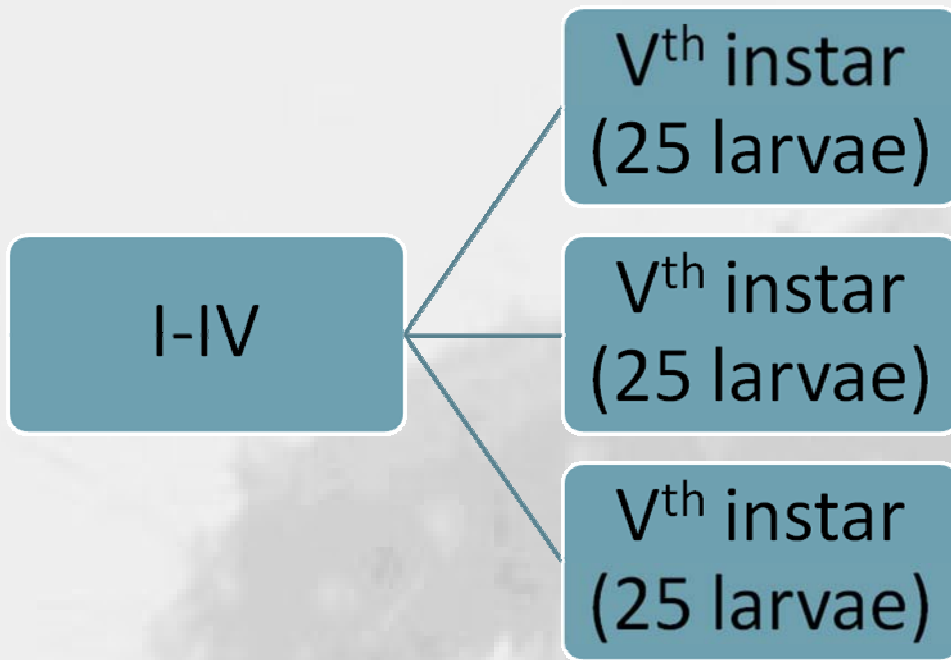
Experiments on mulberry leaves

- Productivity data: cocoon and shell weights; silk ratios

- Efficiency data recorded according to the gravimetric method on fresh material

  - Everyday weighing of:

    - Larvae

    - Left over leaves

    - Faeces

    - Newly added foliage

Experiments on artificial diet

- Rearing in normal and germ-free conditions (Sumida and Ueda 2007)


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118-120,        V^th instar
124-129         (10 larvae)

                V^th instar
                (10 larvae)

                V^th instar
                (10 larvae)
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Experiments on artificial diet

- In germ-free conditions larvae are manipulated only three times during the whole larval period

- In normal conditions larvae were nursed daily

- Productivity and gravimetric data on fresh material were recorded:

  - Twice in germ – free conditions

  - Daily in normal conditions

- As on mulberry leaves results were used to compare strains and select best performing individuals

Within line selection

- Mass rearing on artificial diet and mulberry leaves

- After spinning three-parameter selection

- Back – crossing of adults being over a fixed threshold for cocoon **AND** shell weights **AND** silk ratio

shell

cocoon

ratio

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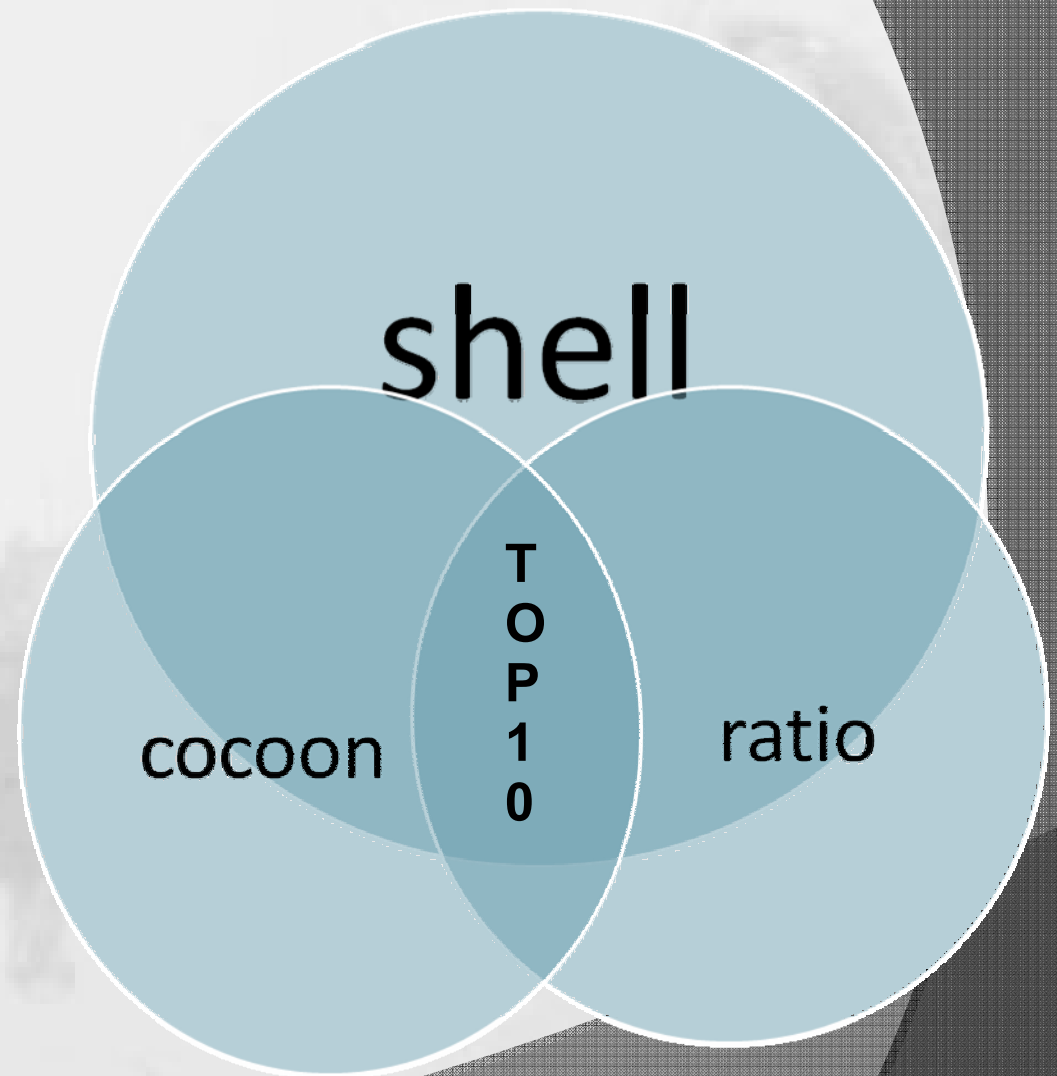
Results summary

Target:

- Selection of 2 strains for hybridization
- Adaptability on mulberry leaf and artificial diet in both normal and germ – free conditions

N° 129
SG III

N° 124
SCI

Best producers

STRAIN (♀)	SILK SHELL (g ± s. d.)	SILK SHELL (g ± s. d.)
129 TOP10	0.369± 0.034; a	0.315± 0.020; ab
124 TOP10	0.349± 0.030; ab	0.278± 0.020; abc
129	0.342± 0.031; b	0.276± 0.027; abc
124	0.314± 0.024; c	0.263± 0.036; bc
V		
118 TOP10	0.308± 0.034; c	---
118	0.304± 0.037; c	---
120	0.299± 0.038; c	---
120 TOP10	0.275± 0.047; d	---

Different letters show significative differences (p-level<0.5); post – hoc
Tukey test; L: mulberry leaves; D: artificial diet – normal conditions

Nutritional indexes

- Nutritional indexes were used to compare strains (artificial diet; germ-free conditions)

STRAIN	A. D. ± s. d.	ECI to larva ± s. d.	ECD to larva ± s. d.
118	39.552± 1.352 ab	28.711± 3.780	72.797± 12.045
120	36.410± 2.652 ab	26.585± 1.622	73.064± 1.359
124	34.807± 3.136 b	27.539± 3.532	80.169± 17.769
129	42.970± 2.648 a	34.428± 3.128	80.424± 9.975

Different letters show significative differences (p-level<0.5); post – hoc Tukey test; L: mulberry leaves; D: artificial diet – normal conditions

Nutritional indexes

- ## Nutritional indexes (art. diet – germ free)

STRAIN	A. D. ± s. d.	ECI to cocoon	ECD to cocoon	ECI to shell ± s. d.	ECD to shell ± s. d.
129TOP10	49.504±2.630 a	13.059±0.925	26.485±3.095 b	2.686±0.116	5.443±0.498 b
129TOP10_	29.525±2.107 bc	11.447±1.008	38.777±2.124 a	2.406±0.135	8.163±0.439 a
129	49.549±2.677 a	13.266±0.766	26.841±2.463 b	2.691±0.123	5.445±0.476 b
129_GF	34.624±1.835 b	13.954±1.171	40.265±1.584 a	2.733±0.203	7.888±0.174 a
124TOP10	46.513±2.093 a	12.268±0.361	26.419±1.622 b	2.677±0.097	5.765±0.347 b
124TOP10_	29.525±2.107 bc	11.447±1.008	38.777±2.124 a	2.406±0.135	8.163±0.439 a
124	50.183±0.631 a	13.071±0.563	26.058±1.456 b	2.640±0.056	5.260±0.063 b
124_GF	28.266±1.837 c	11.272±1.466	39.830±3.612 a	2.733±0.203	8.263±0.818 a

Different letters show significative differences (p-level<0.5); post – hoc Tukey test; L: mulberry leaves; D: artificial diet – normal conditions

After merging data:

- **Production:** - 124,129 > 118, 120
  - spring leaves > diet > late summer leaves > GF diet

STRAIN (♀)	SILK SHELL (g ± s. d.)	>	SILK SHELL (g ± s. d.)
129 TOP10	0.369± 0.034; a		0.315± 0.020; ab
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118 TOP10	0.308± 0.034; c		---
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120 TOP10	0.275± 0.047; d		---

L*: leaves
D**: diet

Different letters show significative differences (p-level<0.5); post – hoc Tukey test; L: mulberry leaves; D: artificial diet – normal conditions

•Efficiency: - after first selections small differences between strains
- evident differences between methods (**distorsion?**)
- germ – free rearing > normal rearing **???**

Selected hybrid:

129TOP10♀ x 124TOP10♂ suited for:

- mass rearing (leaves and diet) for silk production

- germ – free rearing for biotechnological applications

Future perspectives

- Further TOP10 selection

- Hybrid (129TOP10♀ x 124TOP10♂) evaluation (productivity and nutritional indexes)

Thanks to everybody for the attention!