ONGOING COTTON PROJECTS IN EMARI

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ON GOING PROJECTS

Two national cotton breeding projects have been coordinated by our institute.

TAGEM-MAY Breeding of New Varieties by Hybridization and Adaptation Project on Cotton

Southeastern Anatolia Region Cotton Integrated Crop Management Project

ON GOING PROJECTS

Three breeding project have been carried on.

Research on enhancing of the resistance to storm and developing fiber technological properties of the local cotton (*Gossypium hirsutum* L.) variety Çukurova-1518 in Çukurova region

Breeding of Cotton in Çukurova Region

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

ON GOING PROJECTS

Research on enhancing of the resistance to storm and developing fiber technological properties of the local cotton (*Gossypium hirsutum* L.) variety Çukurova-1518 in Çukurova region

- This study is carried out to transfer the resistance to storm and superior fiber technological properties of Delcerro, Sealand-542, Giza-45 to the local cotton variety Çukurova-1518 by using back-crossing breeding method. cv BEREN was registered in 2010 from that project.

ON GOING PROJECTS

Breeding of cotton varieties in Çukurova Region

- This study is carried out to determine the varieties with higher yield and technological properties among the genotypes obtained from abroad or lines bred in our country and to maintain their traits.

ON GOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

- This study is carried out to develop the new cotton varieties with higher fiber quality and yield for Çukurova region.
- For shortening the breeding process a doubled haploidy study is carried out and irradiated pollen fertilization method has been used.
- Besides that a mutation study is carried out in that project.

ON GOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

This study is carried out according to

- the general strategies of 'National Cotton Project'
- with the aim of developing new cotton varieties
- with higher fiber quality and yield for Çukurova region
- as a continuous breeding project.

ON GOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

- In the research three studies are carried out.
  - cross breeding

    (hybridization – pedigree & modified single seed descend*)
  - haploidy tecnique and
  - mutation breeding

*: Double or three seeds are harvested from every plant in that method. Single Seed Descend is adopted to cotton in this way.






ON GOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

CROSS BREEDING

ON GOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

- **Our main aims of breeding for our region are;**
  - high yield
  - improved fiber quality,
  - resistance to storm,
  - suitablity for mechanical harvesting

ON GOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

Method

- Hybridization
- Pedigree selection

have been used as main breeding method.

Besides that for some promising genotypes

- Modified Single Descend Selection

have been used as second method.

Hybridization

Suitable Flower Stage for Emasculation and Pollination

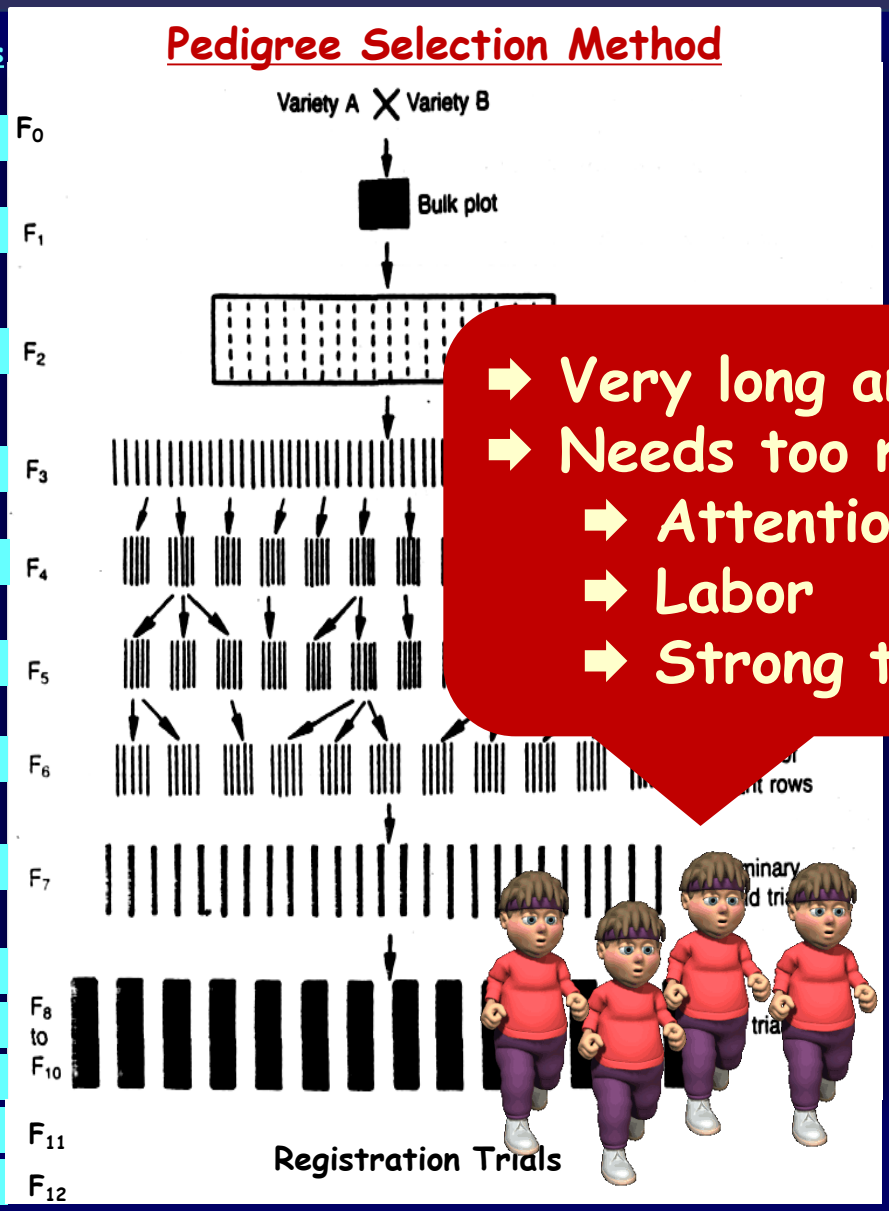
Male

Female – Emasculation

Pollination

ONGOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines



- F_0 Hybridization
- F_1 Bulk Plot
- F_2 Bulk Plot (2000-3000 plants), Selecting F_2 plants
- F_3 Plant Rows, from selected F_2 plants, to 30 plants are grown nparing the standart

erior plants from the ected and planted in rows comparing the in F_4 to F_6, with de of best plants, in best rows.

- By F_7 genotypes should be relatively uniform.
- Preliminary yield trials are planted in F_7 and yield trials are continued through F_{10}.
- After plants are selected in F_3 and F_4, remaining plants in row should be bulked and preliminary yield tests started.

➡ Very long and tiring way
➡ Needs too much
  ➡ Attention
  ➡ Labor
  ➡ Strong team work

ON GOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

With the regular crossing studies

- every year new hybrid combinations are obtained
- for providing the continuity of the breeding process.

- Besides that the seeds of some combinations obtained by crossing at the F_3 stage are send to the other research institutes for providing material exchanging collaboration between the research institutes.

ONGOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

Number of Combinations, Strains, Progeny Rows and Registrating Application Years of the Material Obtained from Crossing Studies

Crossing Year	Number of Combinations	Stages	Number of Strains	Number of Progeny Rows	Registrating Application Year
2003	4	F7	24	__	2012
2004	11	F6	19	__	2013
2005	20	F5	31	64	2014
2006	23	F4	54	108	2015
2007	12	F3	12	180	2016
2008	12	F2	12	__	2017
2009	14	F1	15	__	2018
2010	19	F0	19	__	2019
Totally	115	F0 – F7	186	352	

F4 Material (Pedigree Selection)

No	Combination	2007 Selected F2 Plants	2008 F3 Progeny Rows	2009 F4 Strains	
				Sown	Selected
1	Ç. 1518/Carmen //DES 119	19	4	1	0
2	SG 125/Aydın 110	6	2	1	0
3	Ç.1518/Teks//Fibermax 819	7	4	0	0
4	Des 119/FM 819	26	13	4	4
5	STN 453/FM 819	32	22	10	3
6	SR/R (95-31) 98-1/DES 119	15	9	5	3
7	DP 419/Aydın 110	32	13	7	5
8	Carmen/Deltapine 388	32	20	8	3
9	Çun S2/Adana 98	16	11	3	1
10	DES 119/DP 50	8	4	1	1
11	SG 125/Sicala 33	22	12	7	5
12	Ç.1518/Carmen // BA119///D119	18	11	2	1
13	Ç.1518/Carmen // Sicala 33 ///D 119	15	10	4	4
14	Çukurova 1518 /Aydın 110	11	3	1	0
15	Çukurova 1518//Ç.1518/Giza 45	4	1	0	0
16	Çukurova 1518/DES 119	10	5	1	0
17	Ç.1518/Teks//DES 119	20	10	2	0
18	Adana 98/Aydın 110	18	7	1	0
19	Ç. 1518/Carmen //Tamcot Pyramid	10	1	1	1
20	Çukurova 1518//Ç.1518/Teks	15	5	0	0
Toplam		336	167	59	31

ONGOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

Material Maintained by Modified Single Descent Method

Stage	Combination
F3	Ç.1518/Carmen// Sicala 33///DES 119////DP 419
	Ç.1518/Carmen// Sicala 33///DES 119////ST 488
	SG 125/ Sicala 33//Carmen/ DP 388
	SG 125/ Sicala 33//Fantom
	C.Queen /CA 223
F4	Ç. 1518/Carmen //DES 119
	SG 125/Sicala 33
	Ç.1518/Carmen // BA119///D119
	Ç.1518/Carmen // Sicala 33 ///D 119
	Çukurova 1518/DES 119
	Ç.1518/Teks//DES 119
F6	Ç.1518/Carmen
	Ç.1518/Teks






ON GOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

HAPLOIDY

ON GOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

In the project

- A haploidy study is carried out for shortening the breeding process.
- For this aim irradiated pollen technique in cotton has been firstly carried out in this project in our institute.

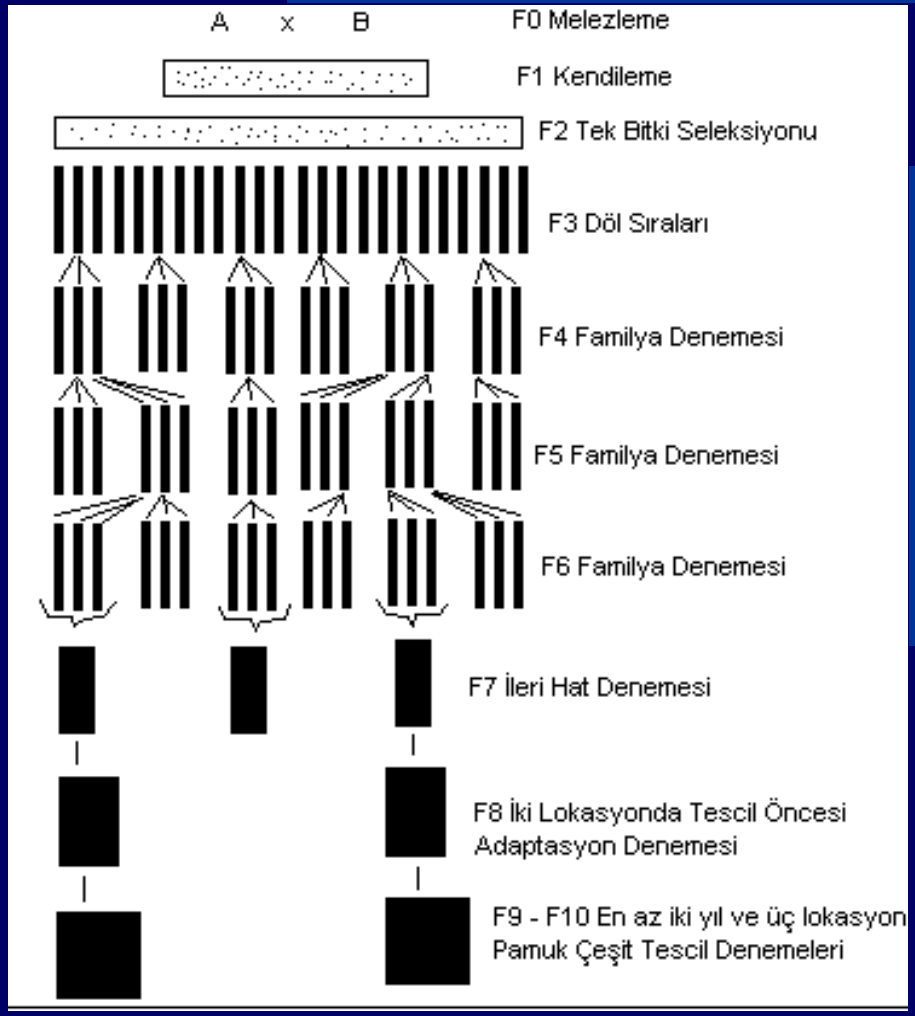
- According to the classical breeding procedure it is needed intensive labor for 5-7 years for purification of the lines after hybridization.

Haploidy Study

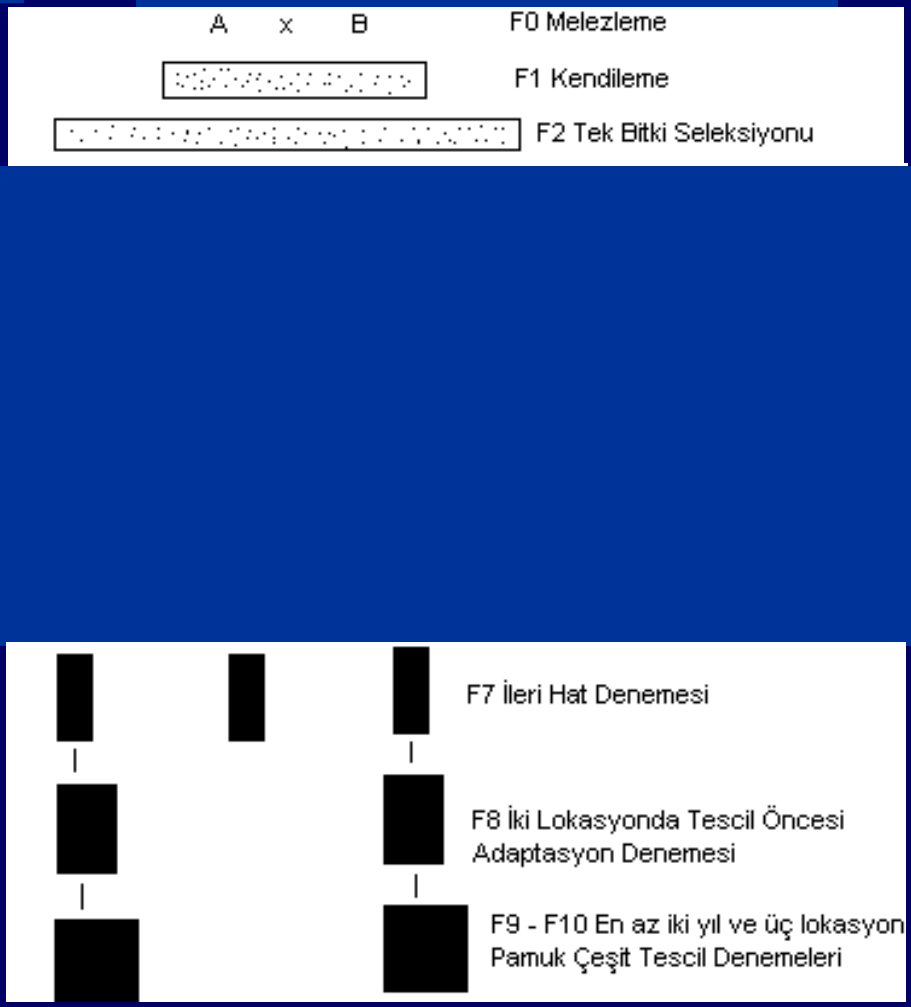
- With the doubled haploid technique,
  - it can be possible to obtain pure lines in a single generation
  - the time required a cultivar developing process can be shortened importantly.
- The important advantage of this method is to be able to obtain 100% homozygous plants in a single generation.

Hybridization followed by a pedigree selection and advantage of doubled haploid technique

Pedigree Selection



Doubled Haploidy



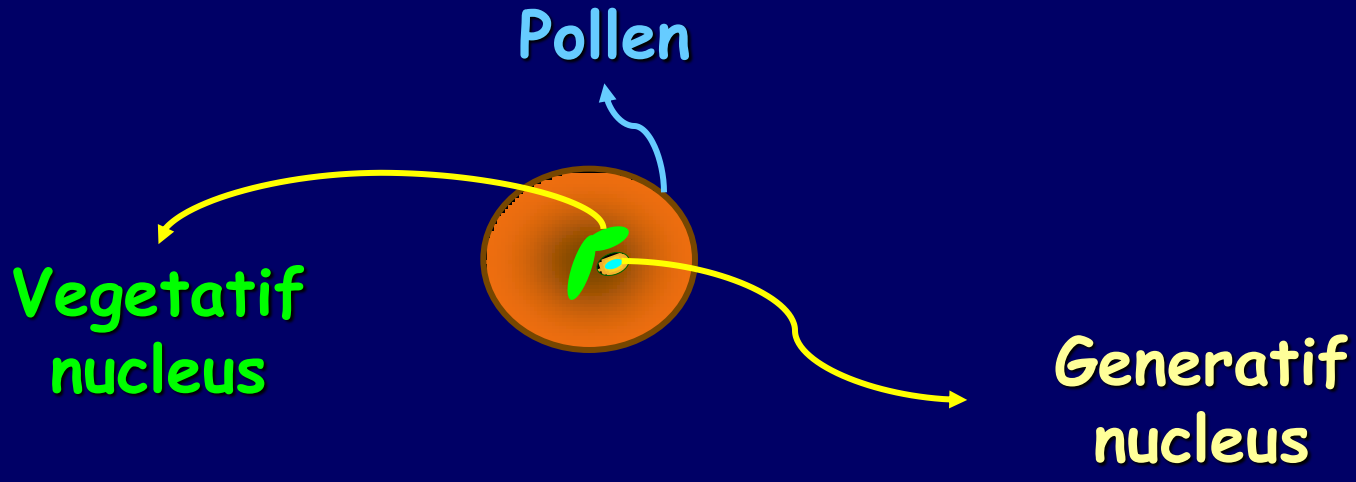
Doubled Haploid Technique

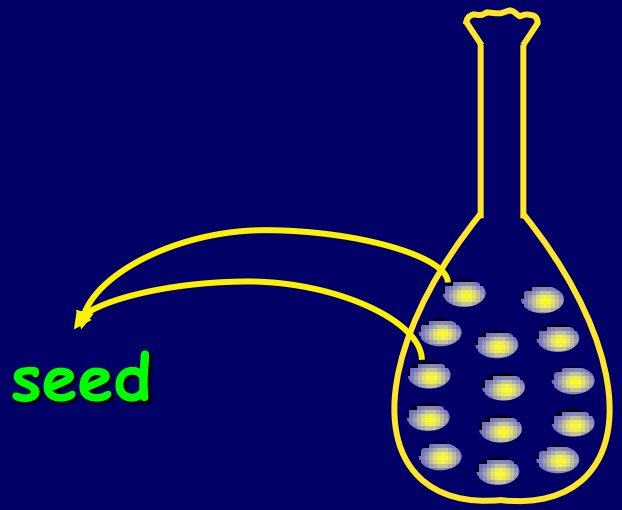
Haploidization techniques have been applied as

- *in vitro* androgenesis
  - anther culture and
  - microspore culture
- *in vitro* gynogenesis and partenosis
  - unpolinated ovule-ovary culture,
  - chromosome elimination,
  - pollination with incomplete pollen.

Irradiated Polen Technique

Normal Fertilization

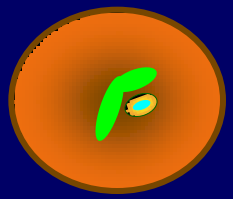




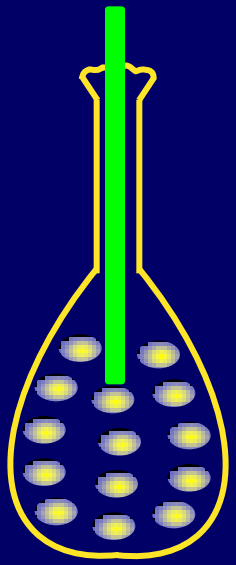
Female Flower

Normal Fertilization

- Pollen comes on the stigma



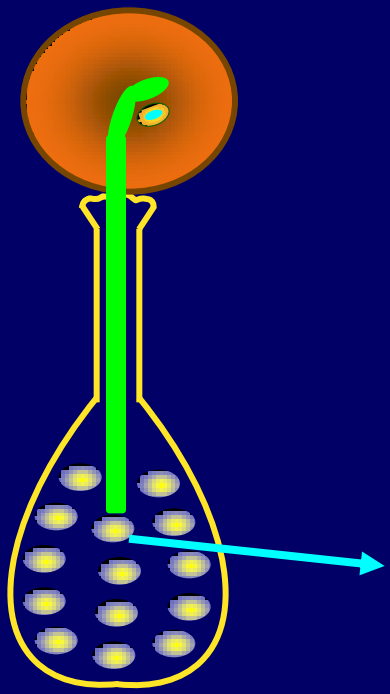
- Vegetative nucleus forms the pollination tube



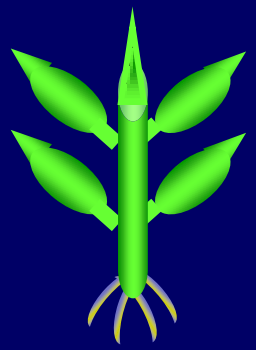
Normal Fertilization

It is expected:

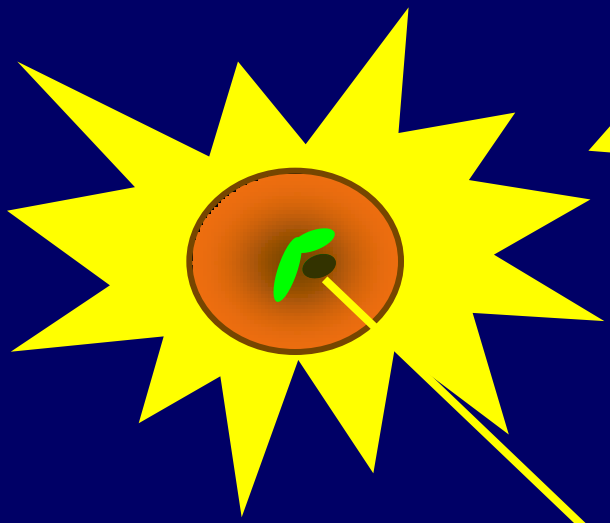
- Pollen comes on the stigma
- Vegetative nucleus forms the pollination tube
- Generatif material goes to embryo sac



Normal plant is formed with 2n chromosome number



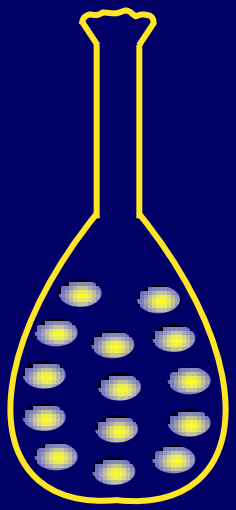
Irradiated Pollen Tecnique



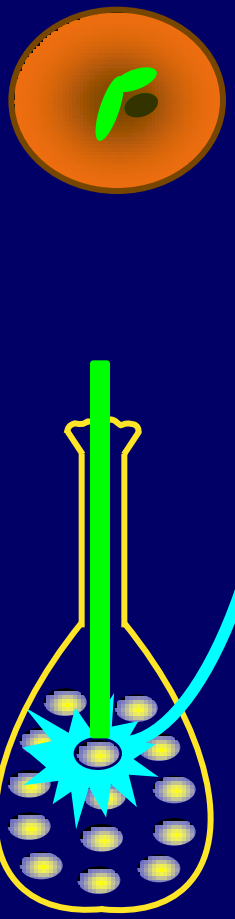
Polen Irradiation

It is expected:

➡ Generative nucleus is inactivated (incomplete pollen)



Irradiated Pollen Tecnique



Haploid Embryo Induction

Embryo formation from the haploid cells in embryo sac. (antipod, synergid and especially egg cell)

➡ Generative nucleus is inactivated (incomplete pollen)

Haploid Plant Formation

Rescue Haploid Embryos

In vitro culture of the embryos at an early stage

➡ Vegetative nucleus is activated for formation of pollination tube and stimulating the embryo sac.

Doubling Chromosomes

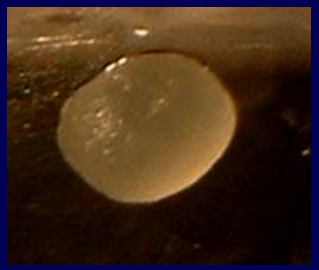
Homozygous, fertil plant with 2n chromozom number

Investigated Traits

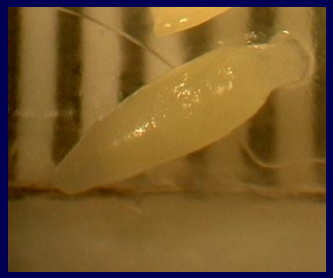
Shapes and Development Stages of Embryos Cultured *In vitro*

Point

Globular



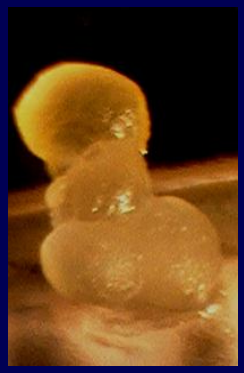
Arrow Tips



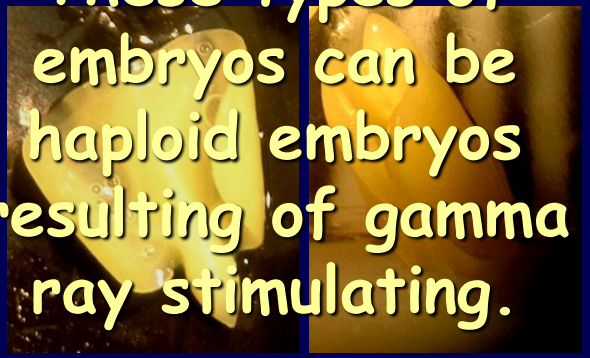
Heart

Torpedo

Amorphous



Diploid (Control)



These types of embryos can be haploid embryos resulting of gamma ray stimulating.

Haploidy Studies

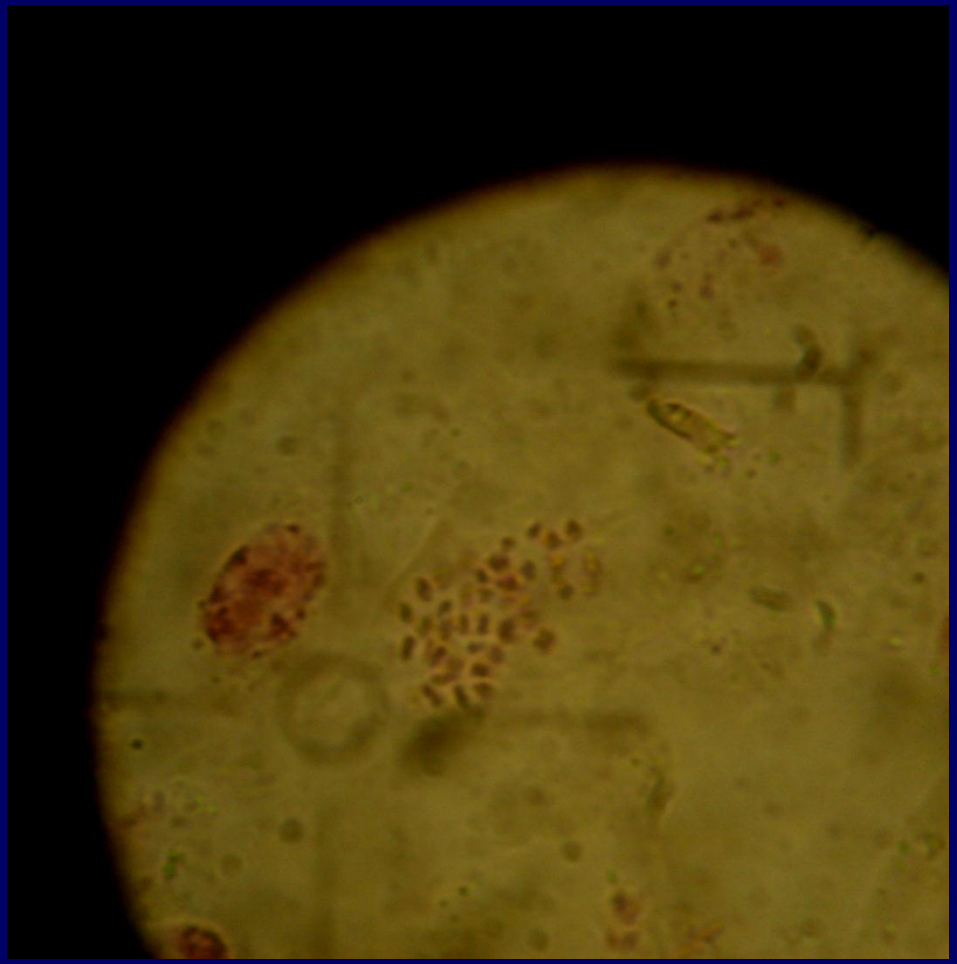
With the irradiated pollen technique;

- We cultured lots of haploid embryos
- We obtained ten rooted haploid plants
- It was proved that two of them were haploid after chromosomes counting
- Unfortunately they died due to bad growing conditions of growth room
- We have more than 200 embryos in culture now and we have been studying on them.

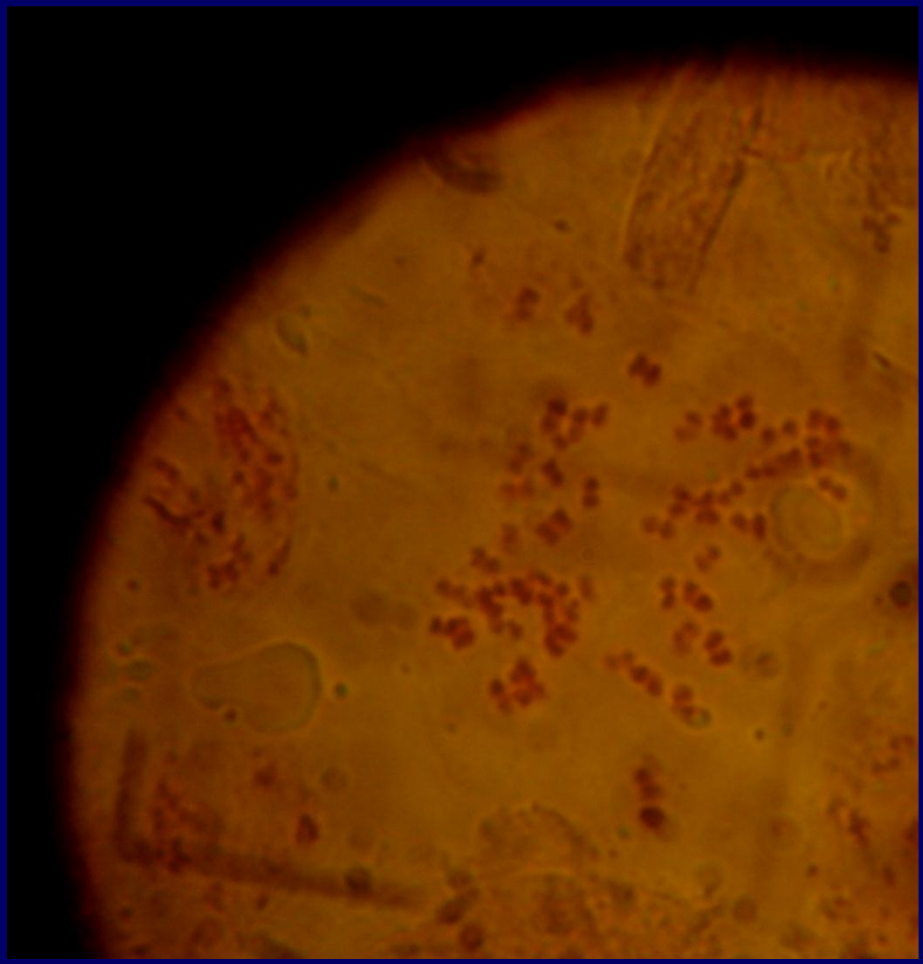
2007 Haploidy Studies

2007 Haploidy Studies

Chromosome Observations



Haploid



Diploid

Summary

Haploidy - Irradiated Pollen Study

Year	Ray Dose	Embryo Age	Number of Pollinated Flowers	Number of Investigated Seeds	Number of Embryo cultured in vitro	Number of Rooted Seedlings
2005	7	1	140	345	0	0
2006	5	7	420	2145	27	0
2007	4	2	802	4951	250	10
2008	4	1	979	4216	582	0
2009	1	1	342	3995	583	28

Sub Culture studies for suitable in vitro conditions and determining ploidy level are still carried on...

Emasculation of female flower

Preparation of male flowers for irradiation


120
100
0
300
320
380

Irradiation of pollens

(Turkish Atomic Energy Authority-Ankara

Pollination

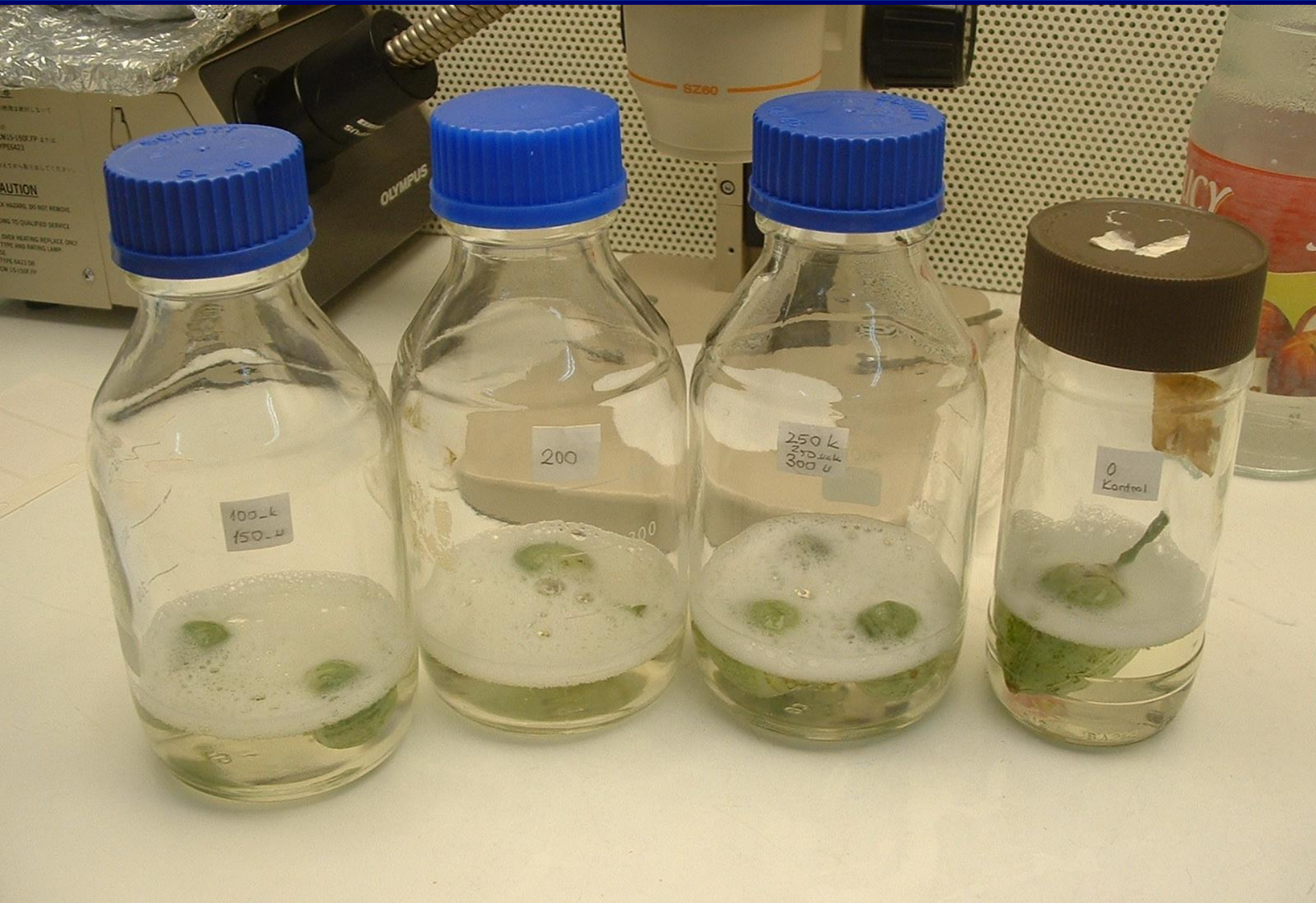
Before irradiation

After irradiation

Shading of female plants

Harvested bolls

Surface Sterilization of the bolls

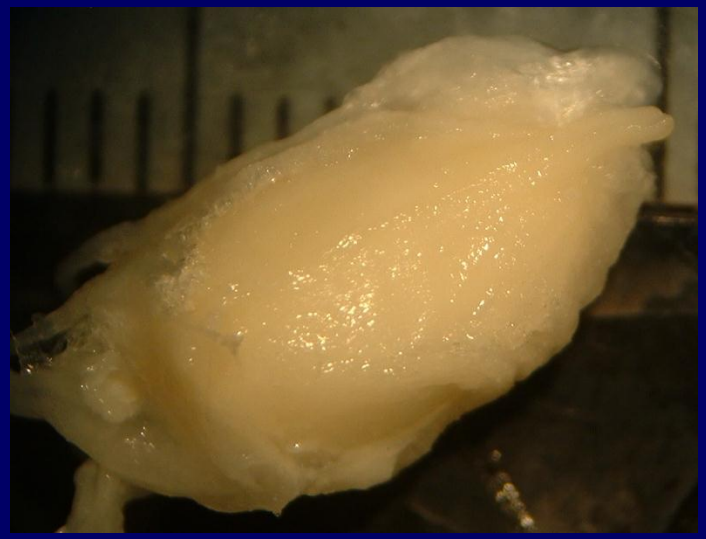


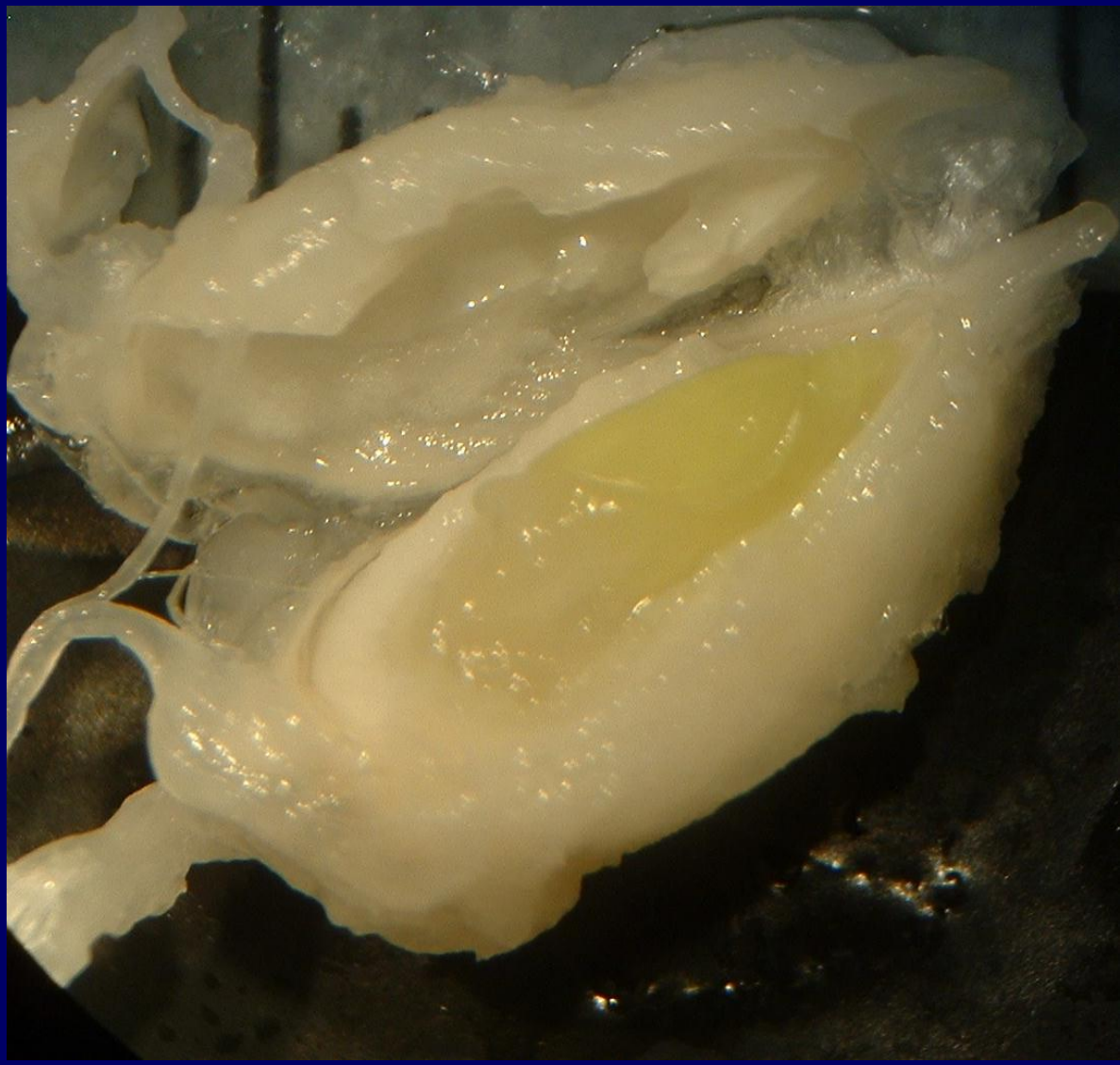
In vitro culture of the embryos (18 days old)

18. Days

Control

0 Gray



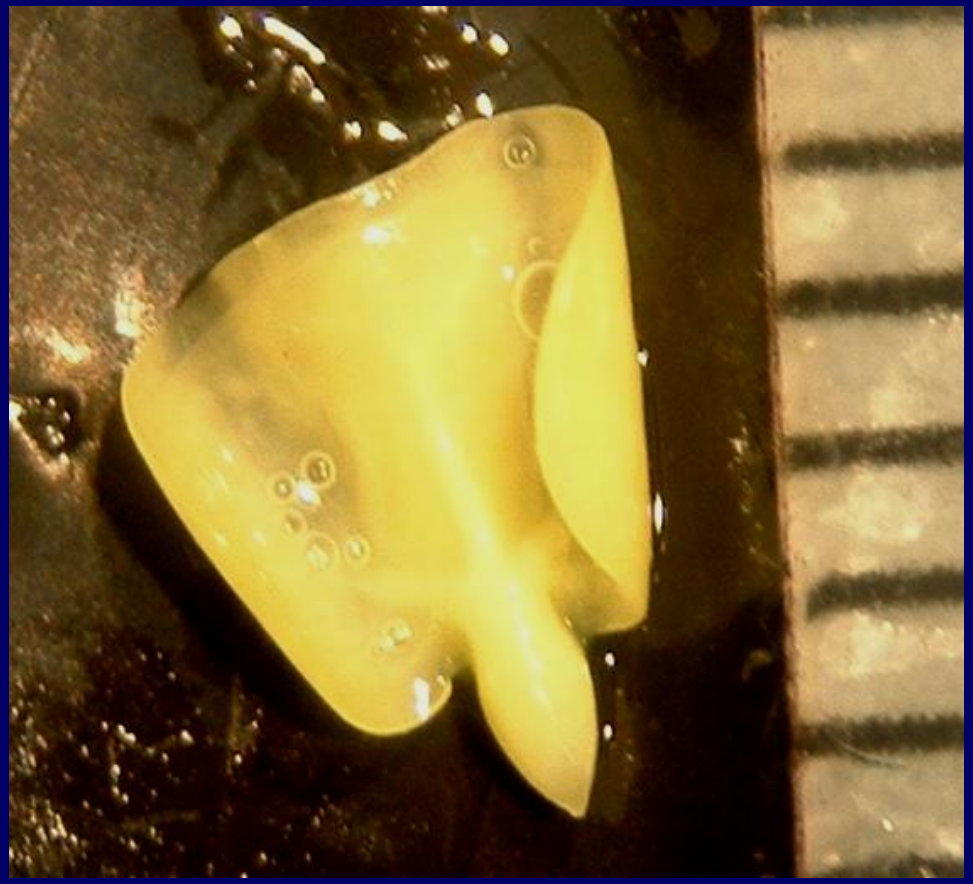


Diploid Embriyo

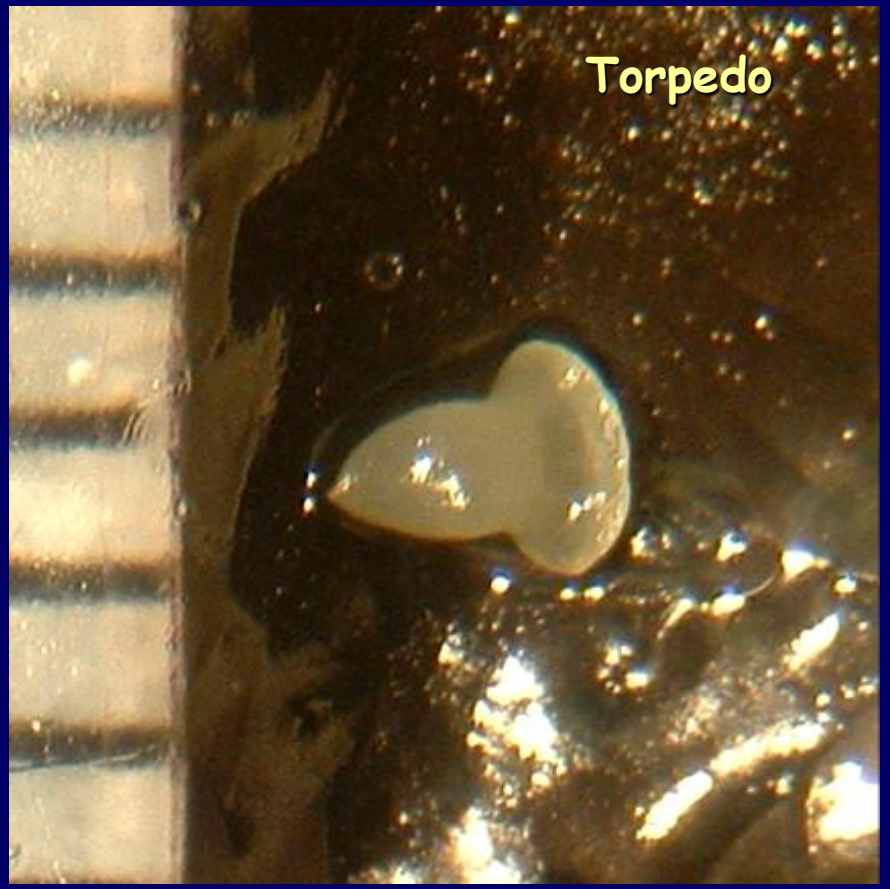
In vitro culture of the embryos (18 days old)

Same Ages Embryos (18 days old)

Kontrol - 0 Gray **100 Gray**



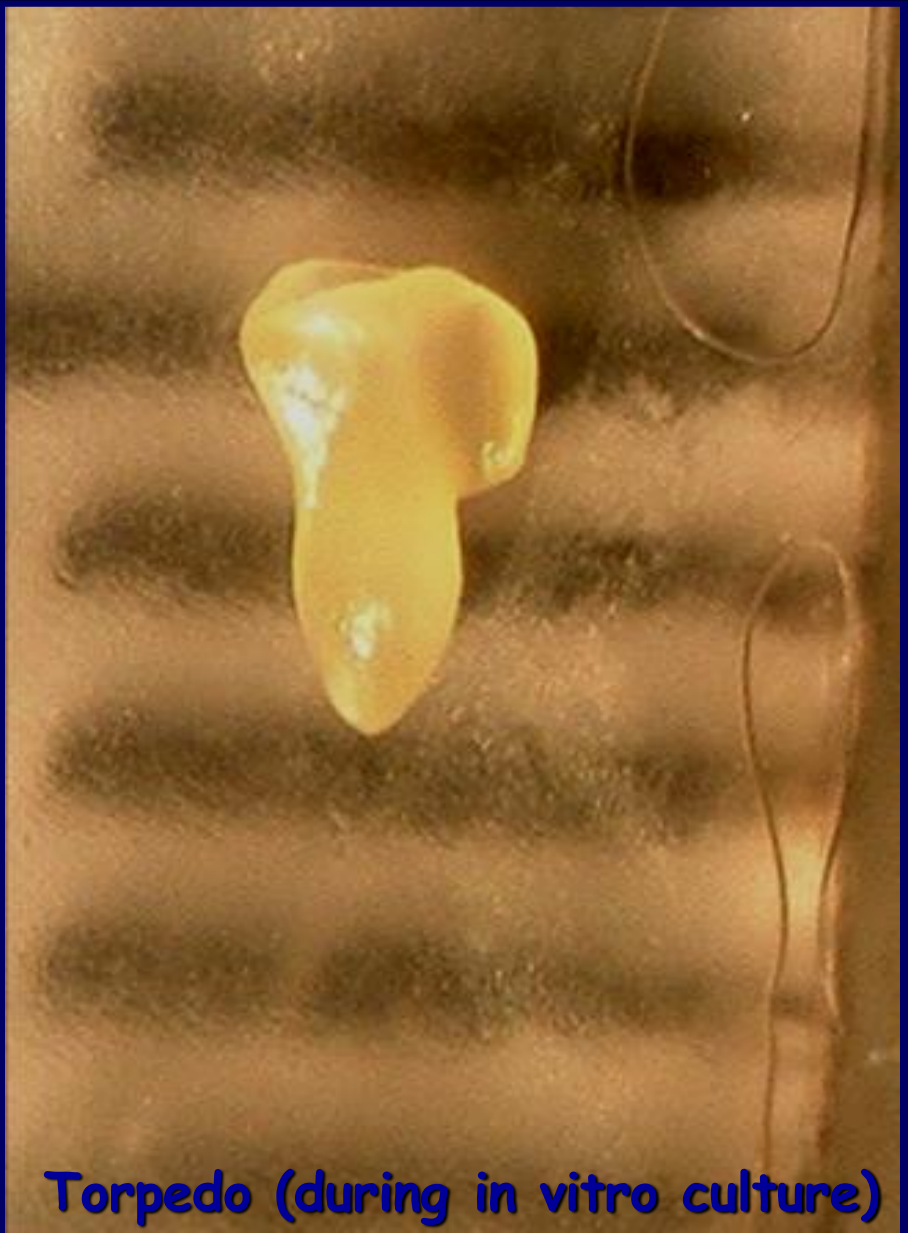
Diploid Embriyo



Can be Haploid


100 Gray
Can be haploid
Control - 0 Gray
Diploid
18 days old

2007 Haploidy Studies



Torpedo (during in vitro culture)

cotyledon (Subculture)

2007 Haploidy Studies

Chromozom Counting






ON GOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

MUTATION

ON GOING PROJECTS

Breeding of cotton varieties for higher fiber quality and yield by hybridization and using the biotechnological methods during purifying the lines

In the project

- A mutation study is carried out to induce variation effect of mutation through gamma irradiation.
- In that study plants with fuzzless seeds were obtained and the researches on inheritablity and maintenance of fuzz trait are carried on.

Mutation Study (2005)

Gamma Ray Treatment to F1 seeds - 2005

F1

ADN 03 01

Cobalt^{60} ray

➡ 250 Gray

➡ 400 Gray

F1

ADN 03 02

Mutation Study (2005)

Mutation Study (2005)
The Chimeric plant which has both fuzzles and fuzzy seeds

Mutation Study (2005)

The Chimeric plant which has both fuzzles and fuzzy seeds

Mutation Study (2005)

Mutation Study (2008)

- The fuzzless seeded plants were maintained by the pedigree selection method

Mutation (2005-2009)

Seed Trait	Growing Year	Stage	Rate%		
			Fuzzles	Semifuzzy	Fuzzy
Fuzzles (M_1)	2006	M_2	1,2	2,4	96,4
Fuzzles (M_2)	2007	M_3	18,7	31,3	50,0
Fuzzles (M_3)	2008	M_4	41,3	21,3	37,4
Fuzzles (M_4)	2009	M_5	59,7	21,1	19,2

Mutation Study Fuzzy Seed

Mutation Study Semifuzzy Seeds

Mutation Study Fuzzles Seeds

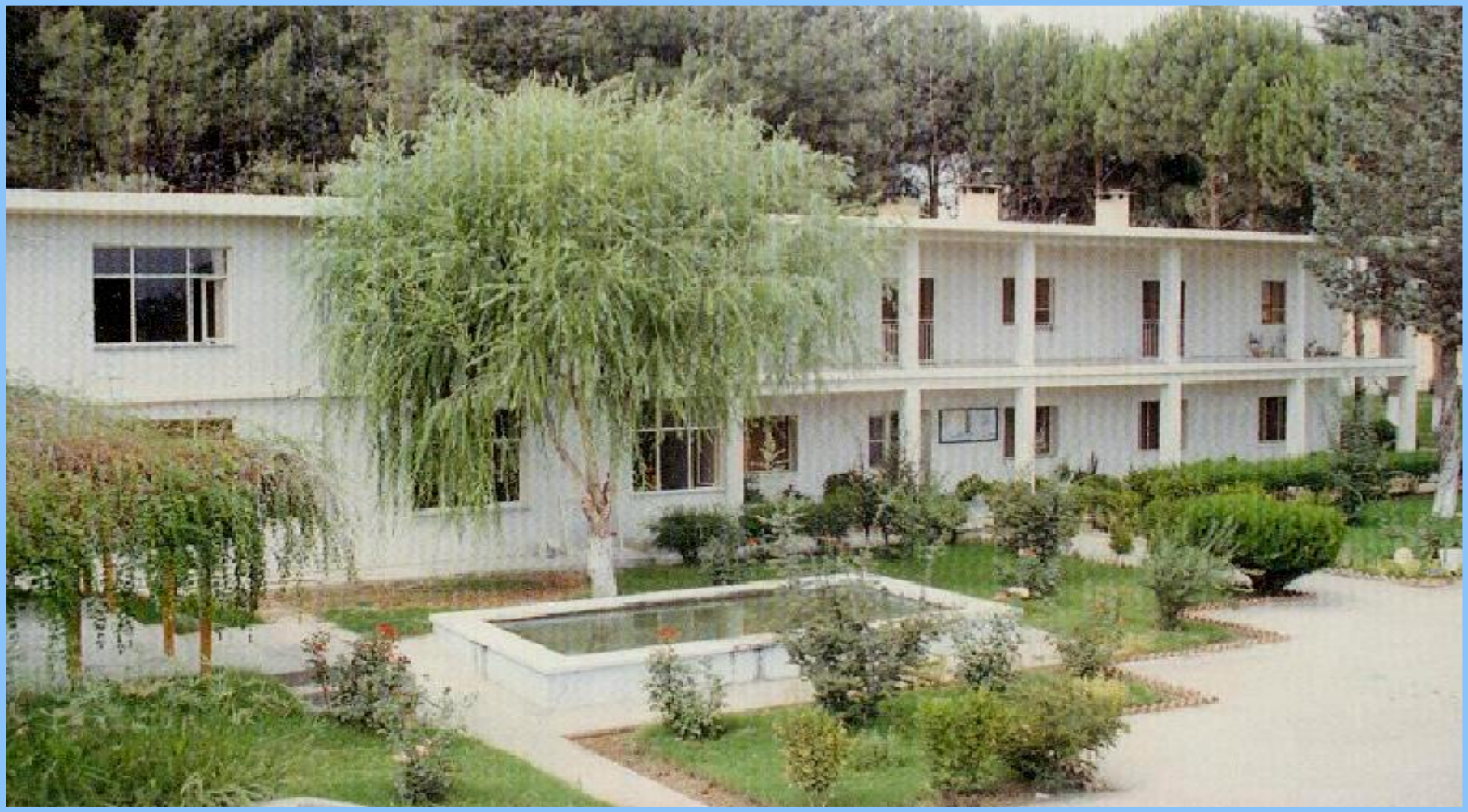
Mutation Study
Fuzzles seeds






Some Photos from EMARI

EMARI



Experiment Area

Hybridization

Suitable flower stage

Male Flower

Female Flower (Emasculation)

Pollination


Experiment Area

Experiment Area

Mechanical Harvesting Study on Cotton

Plant Monitoring Project

Natural Crossing Study on Cotton

Natural Coloured Cotton Study


THANK YOU