

VIPS
Viikki Plant Science Centre



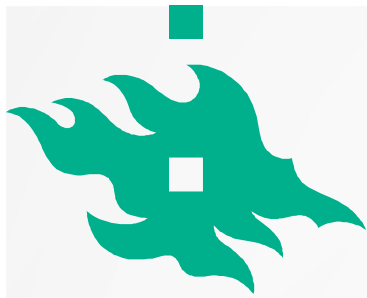
MANSIKAN KUKKAVANA- ANALYYSIN TULKINTA

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Maataloustieteiden osasto, Viikki Plant Science Centre**

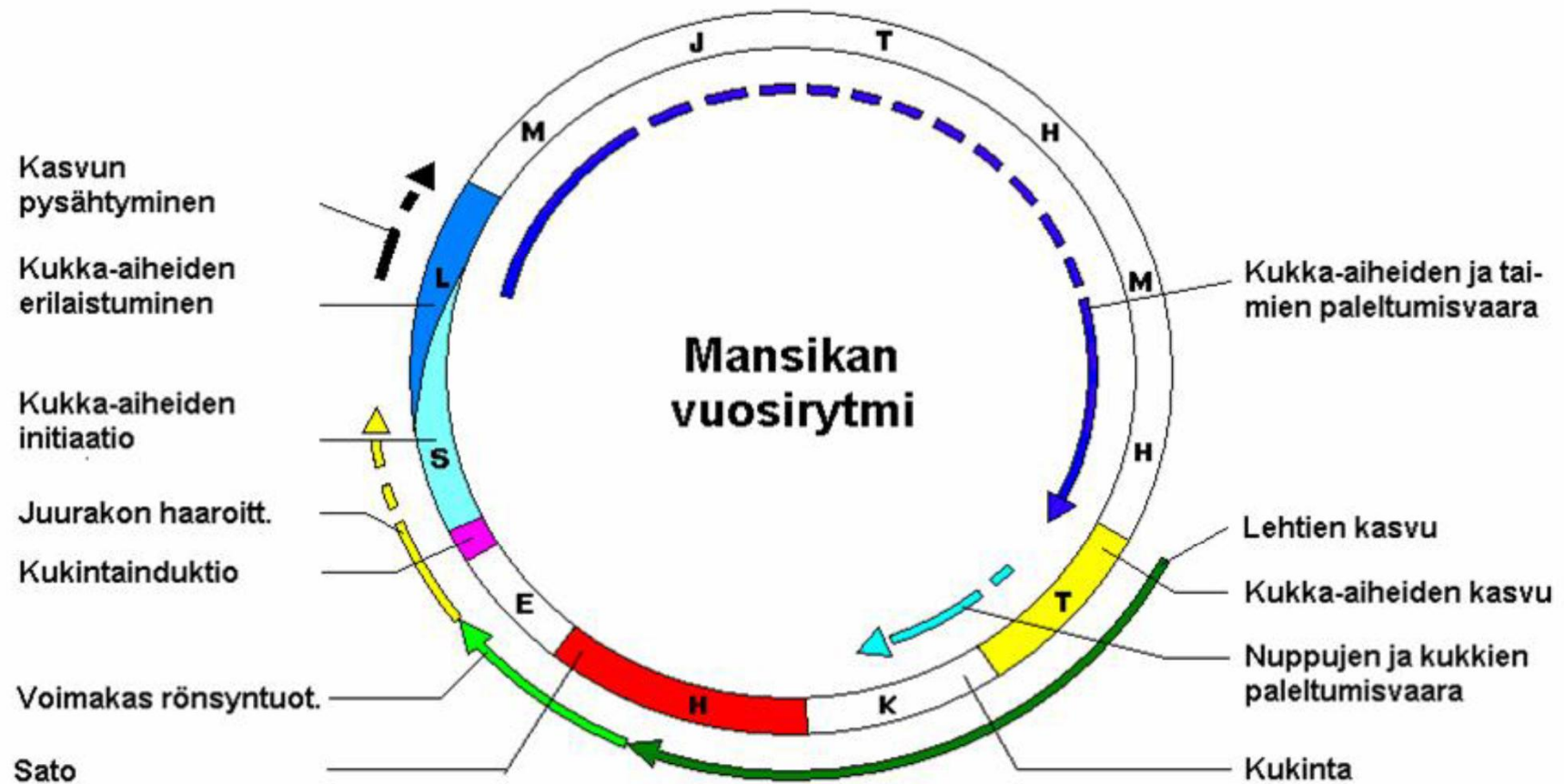


MITÄ KUKKAVANA- ANALYYSI KERTOO?

- Arvio sadon suuruudesta, kun kukinnot ovat vielä juurakon sisässä
- Onko kasvi vegetatiivinen vai generatiivinen
- Kukkavanojen mahdollinen määrä juurakossa
- Sadon alun ajoittuminen
- Kuinka pitkälle aikavälille sato ajoittuu
- Juurakonhaarojen lukumäärä



MANSIKAN VUOSIKIERTO





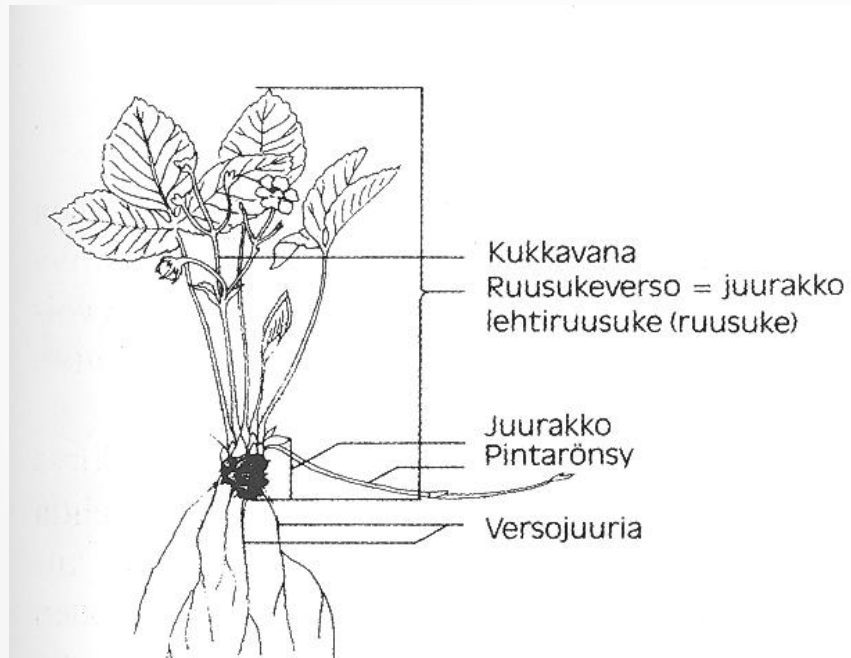
MANSIKKA

- Juurakko tai juurakonhaara on mansikan verso (tiivistynyt!)
- Joka lehden hangassa on silmu
- Hankasilmusta voi tulla lehtiä, kukintoja, juurakonhaara tai rönsy

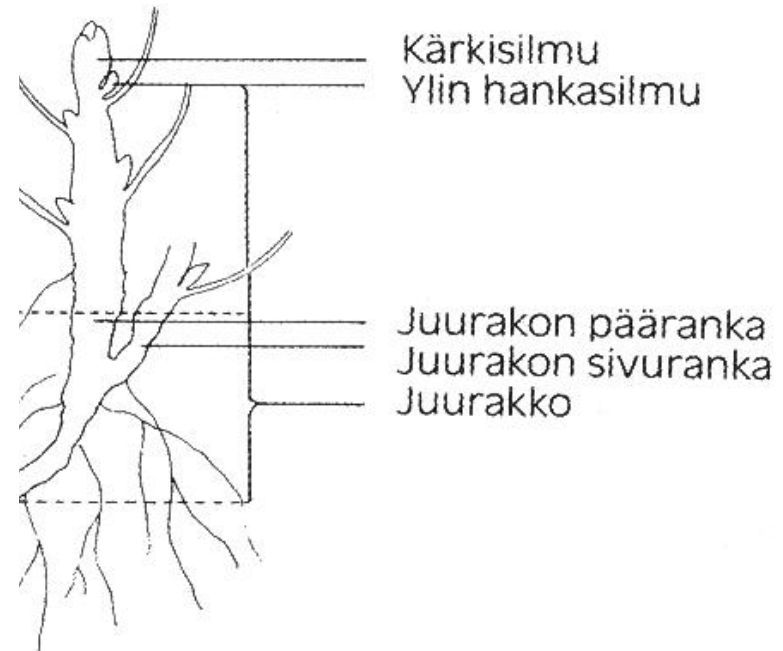


PUUTARHAMANSIKKA

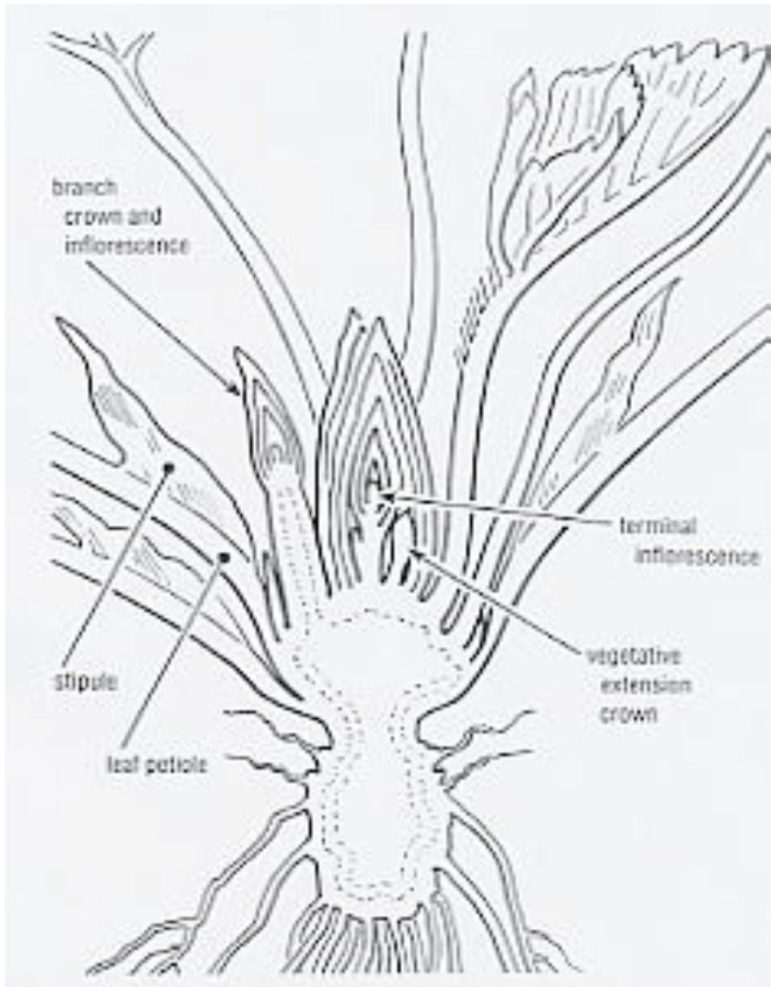
Fragaria x ananassa Duch.



Kuva 1. Mansikkakasvin osat



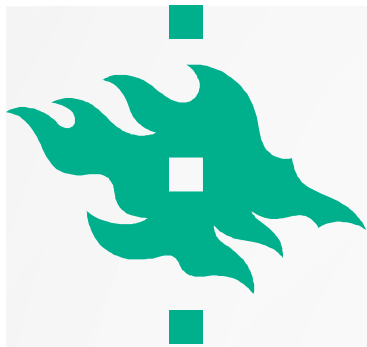
Kuvat: Matala 2006. Mansikan viljely.



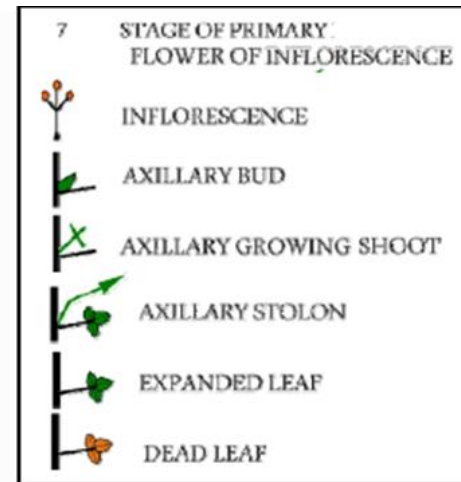
Integrated Pest Management for Strawberries, Publication 3351, Univ. Calif., 1994



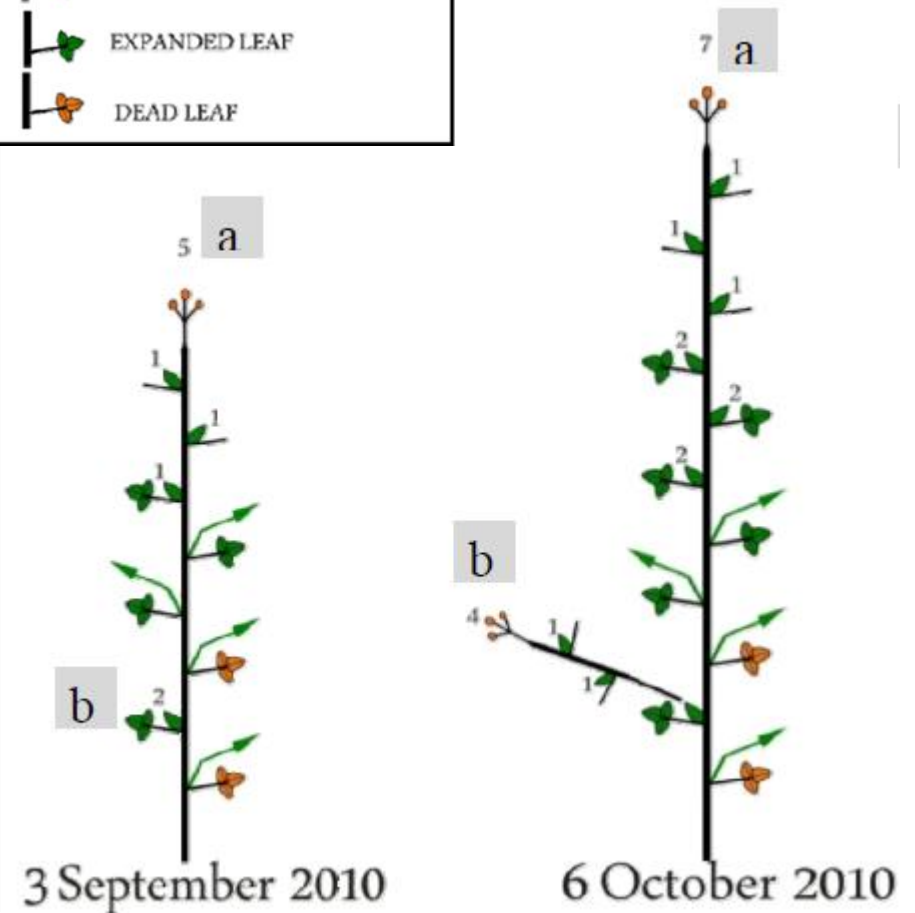
<https://www.ces.ncsu.edu/wp-content/uploads/2014/02/damage-to-chan-crown.jpg>

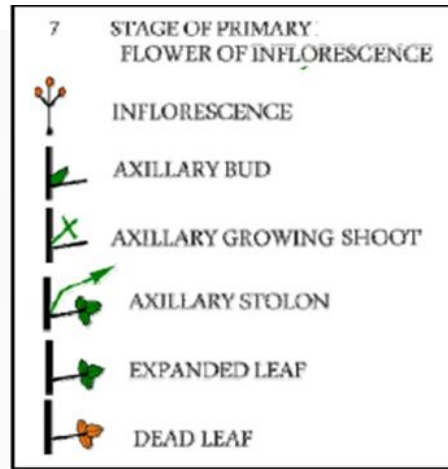
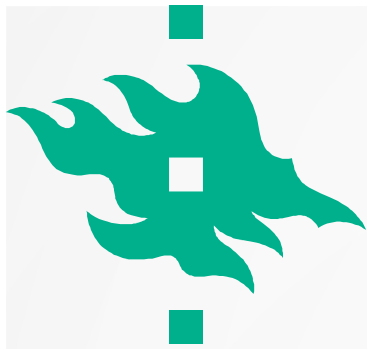


- Kukintainduktio (a) 27.8. Ennen sitä vain rönsyjä alemmista hankasilmuista.
- Viikkoa myöhemmin kukintainduktio alemmissa hankasilmuissa (b), joissa ei rönsyä.
- 6.10. kärkisilmun kukinnossa (a) kaikki kukan osat kehittyneet, alemmassa hankasilmuissa kukka kehitysasteella 4 (verholehdet erilaistuneet)



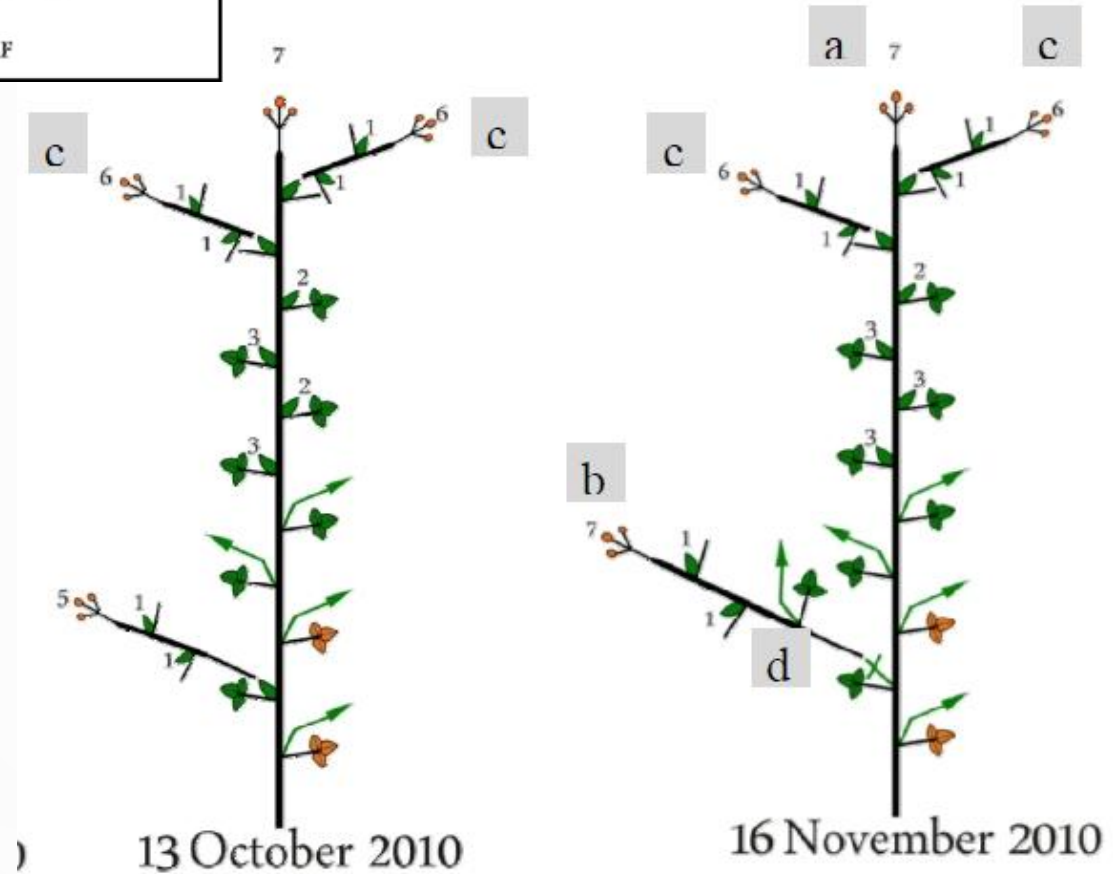
'Clery'

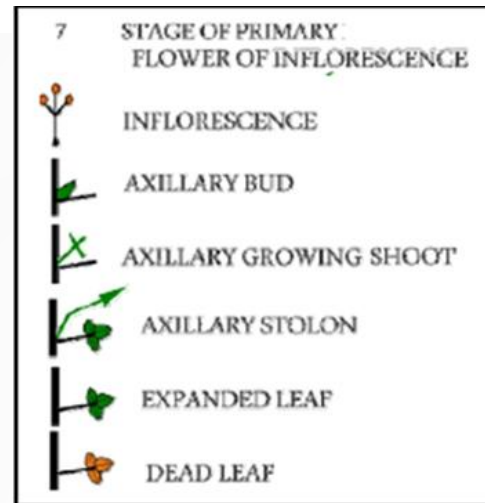




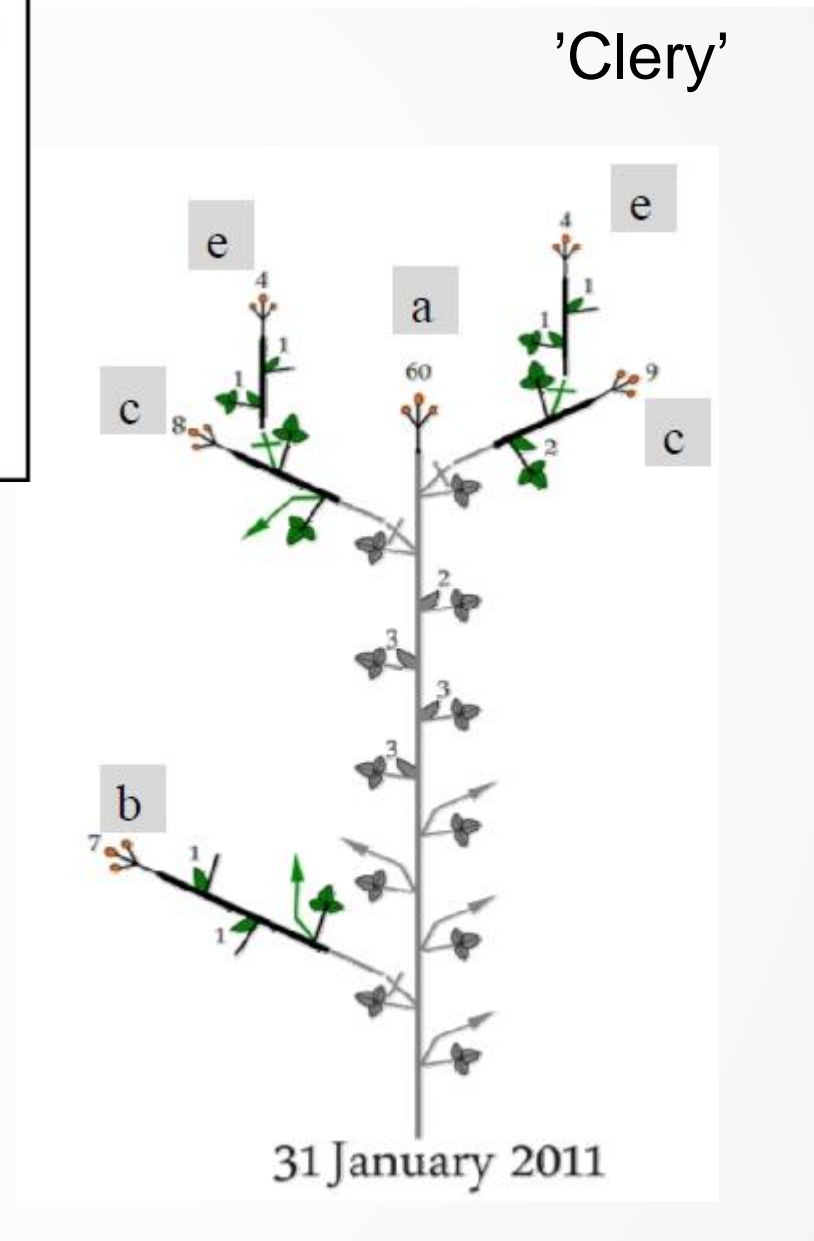
'Clery'

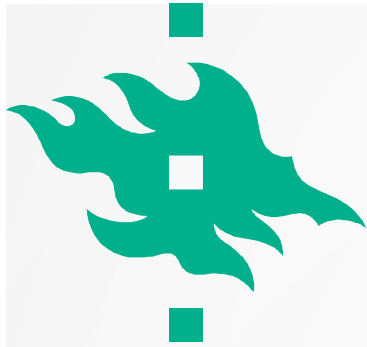
- Viikkoa myöhemmin nopea kukintojen kehitys alkoi kahdessa hankasilmussa kärkikukinnon alapuolella (c)
- 16.11. frigovarastoon
- Kehitysaste 6: heteet erilaistuneet (c)
- Kehitysaste 7: emit erilaistuneet (a, b)





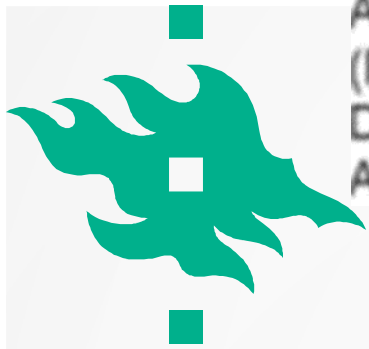
- Istutus 14.12.
- Ensimmäisenä puhkeaa kärkikukinto (a)
- Kaksi kukintoa kärkikukinnan alapuolella (c) kehittyivät nopeammin kuin alemmissa hankasilmuissa olevat kukinnot (b)
- Valotus 4-28.1.
- Valotuksen päätyttyä kukintoja erilaistui kärkikukinnan alapuolella oleviin hankasilmuihin (e)
- -> toinen sato





KUKINTAINDUKTIO MANSIKALLA

- **Induktio:** kasvi virittyy kukkimaan, ei vielä mitään näkyviä muutoksia
- **Initiaatio:** kukka-aiheiden muodostuminen / kehittyminen alkaa
- **Erilaistuminen:** kukan eri osat (terälehdet, verholehdet, heteet, emit) kukka-aiheissa kehittyvät ja ne voidaan erottaa



A morphological study of flower initiation and development in strawberry (*Fragaria x ananassa*) using cryo-scanning electron microscopy.
D.R. Taylor, P.T. Atkey, M.F. Wickenden and C.M. Crisp
Ann. Appl. Biol. (1997), 130:141-152



Fig. 1. Morphology of the vegetative apex of strawberry (cv. Elsanta) prior to initiation of the inflorescence. The apical dome (a) is relatively flat and tends to be partially enclosed by the developing stipules (ls) of youngest leaf. (bar = 0.1 mm).



Fig. 2. Morphology of an apex exhibiting the first signs of initiation of the inflorescence. The apical dome has become raised above the level of the developing stipules, broadened and more convex in shape. (bar = 0.1 mm).

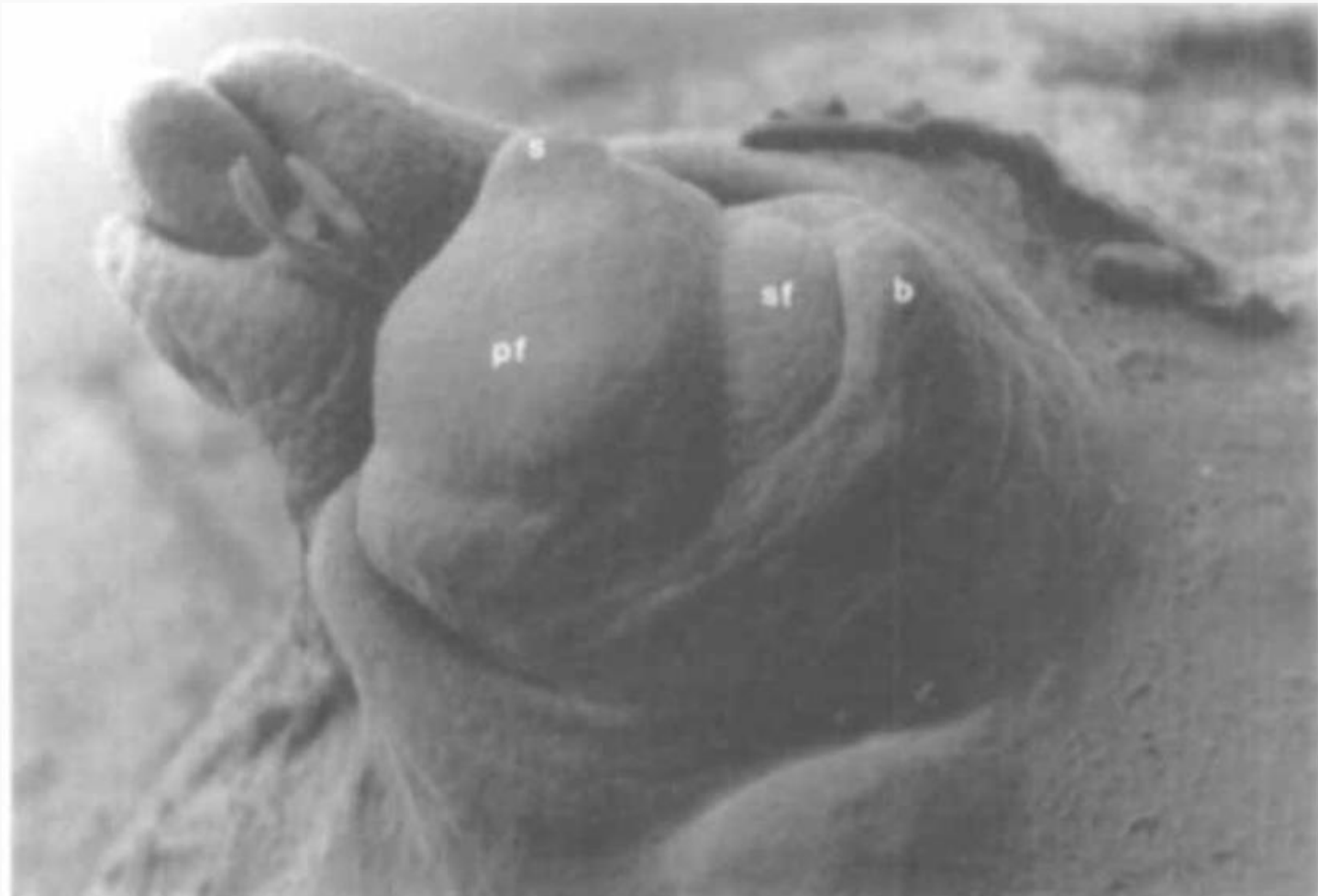


Fig. 3. An apex with the first bract primordium (b) distinguishable from the clearly separate, larger primary and secondary flower primordia. The primary flower primordium (pf) has become flattened with the beginning of a sepal primordium (s) also visible, while the secondary flower primordium (sf) is convex in shape. (bar = 0.1 mm).

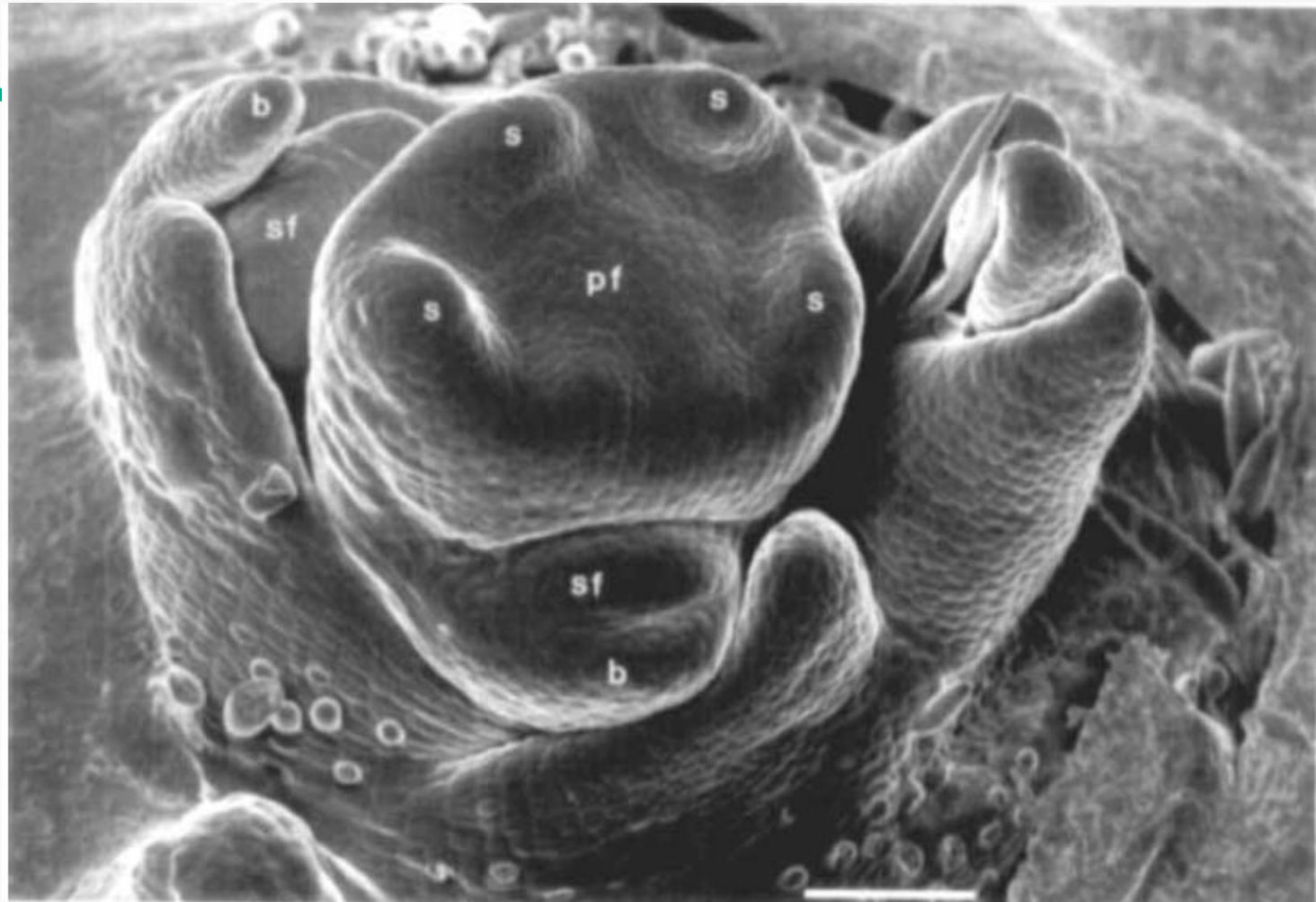
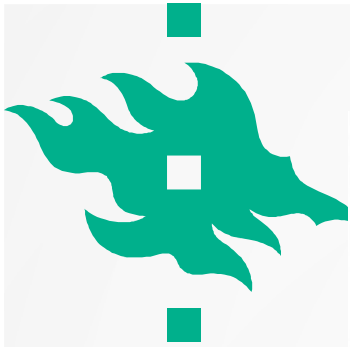


Fig. 4. At this stage of development, the primary flower primordium (pf) has four clearly distinct sepal primordia (s) differentiated around its periphery, and has elongated further. Two secondary flower primordia (sf) and their attendant bract primordia (b) are also visible. (bar = 0.1 mm).

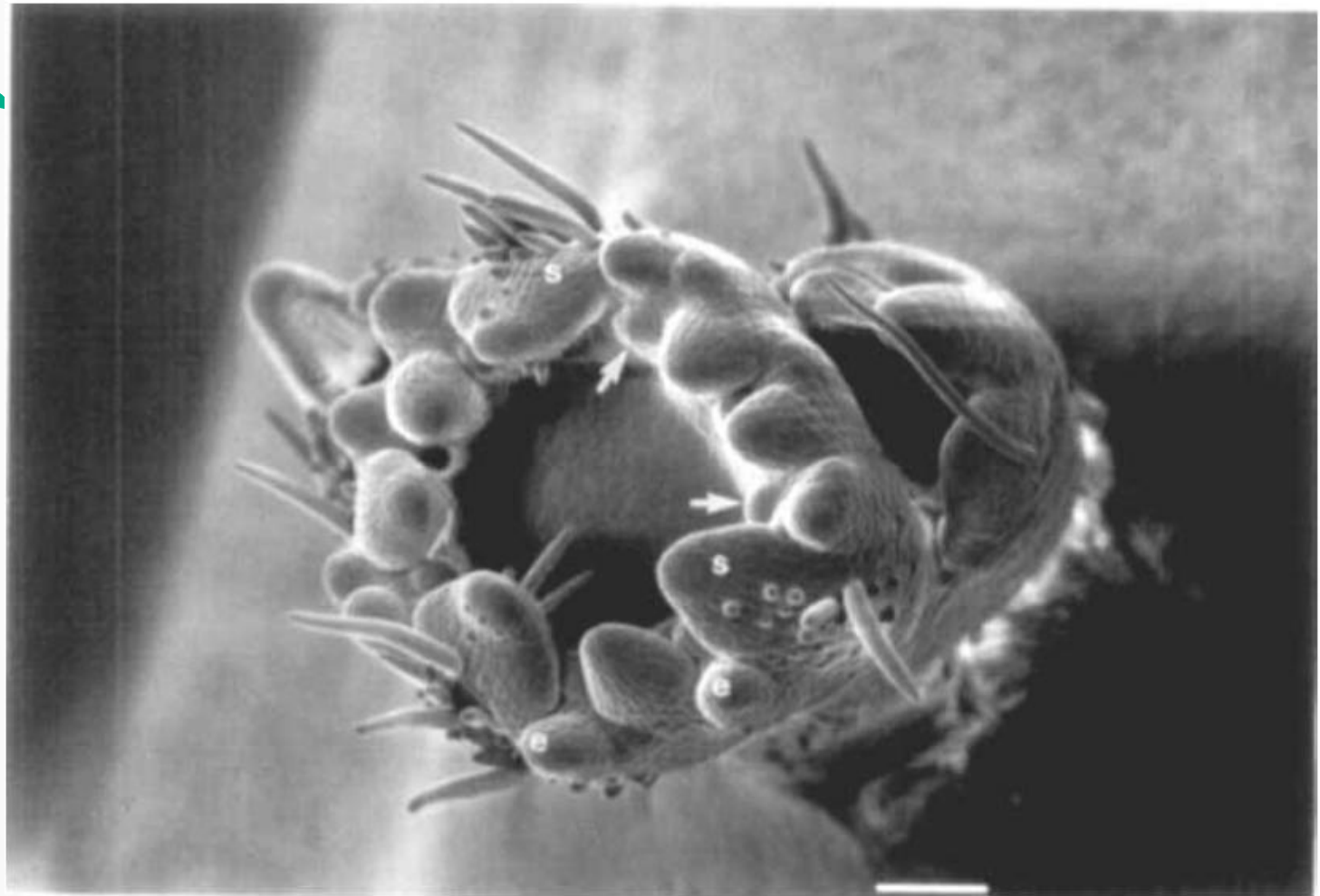
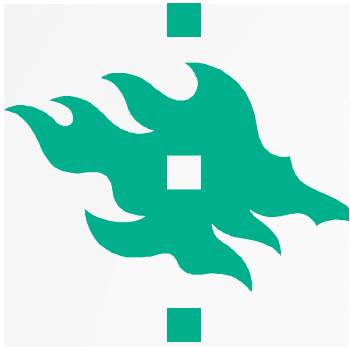


Fig. 5. Sepal primordia (s) have elongated, with hairs and hair initials visible on the abaxial and adaxial surfaces. Primordia of the epicalyx lobes (e) have been initiated centrifugally outside the ring of sepals. Petal primordia (arrowed) have also initiated, apparently simultaneously, and are visible as small bulges between the sepal primordia, adaxial to the epicalyx lobe primordia. (bar = 0.1 mm).

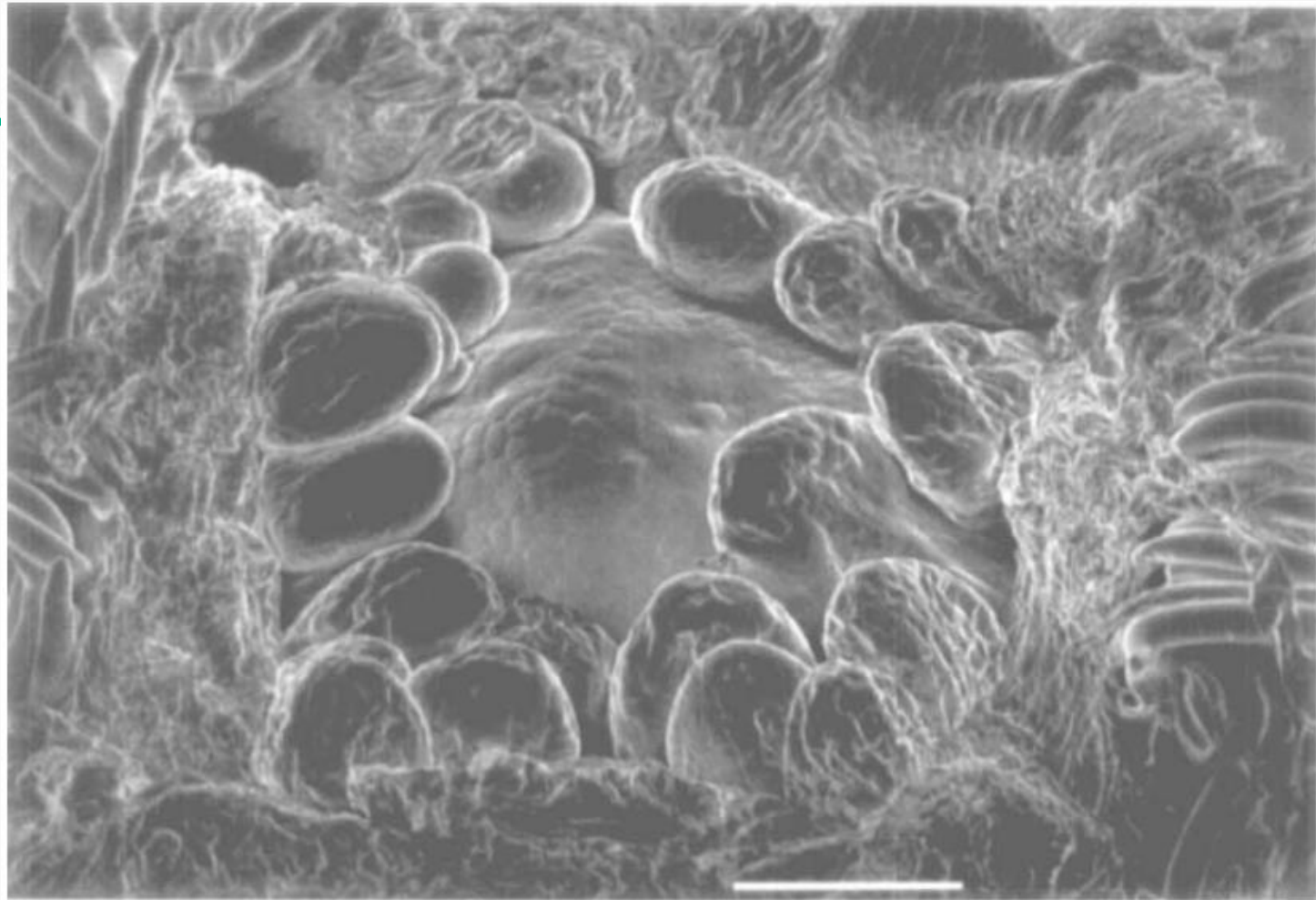
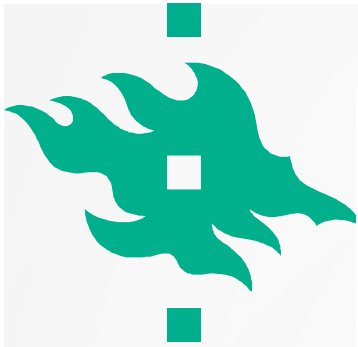


Fig. 6. Sepals and epicalyx lobes have been removed to reveal the whorls of stamen primordia initiated acropetally. Petal primordia are also probably present, but it is difficult to distinguish these from the stamens during this particular phase of development. Some dehydration of the specimen is evident in this micrograph, due to the increased time required for dissection of the floral primordia at this stage. (bar = 0.1 mm).

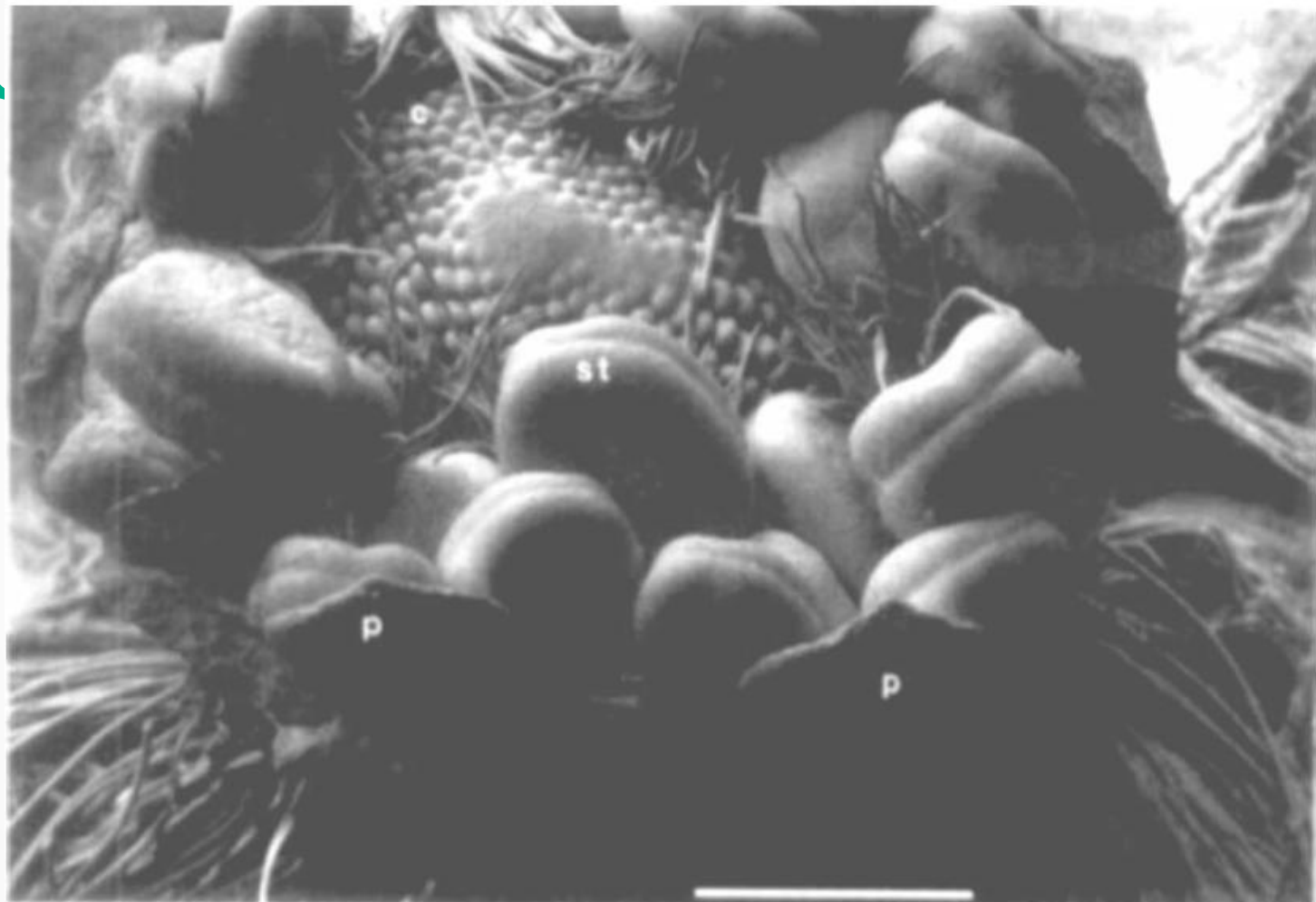
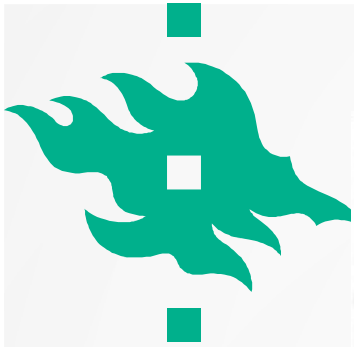


Fig. 7. Initiation of the carpel primordia (c) has begun at the periphery of the receptacle and proceeds centripetally, the central region still being undifferentiated at this stage. Sepals and epicalyx lobes have again been removed, but the petals (p) and stamens (st) have been retained. (bar = 0.5 mm).

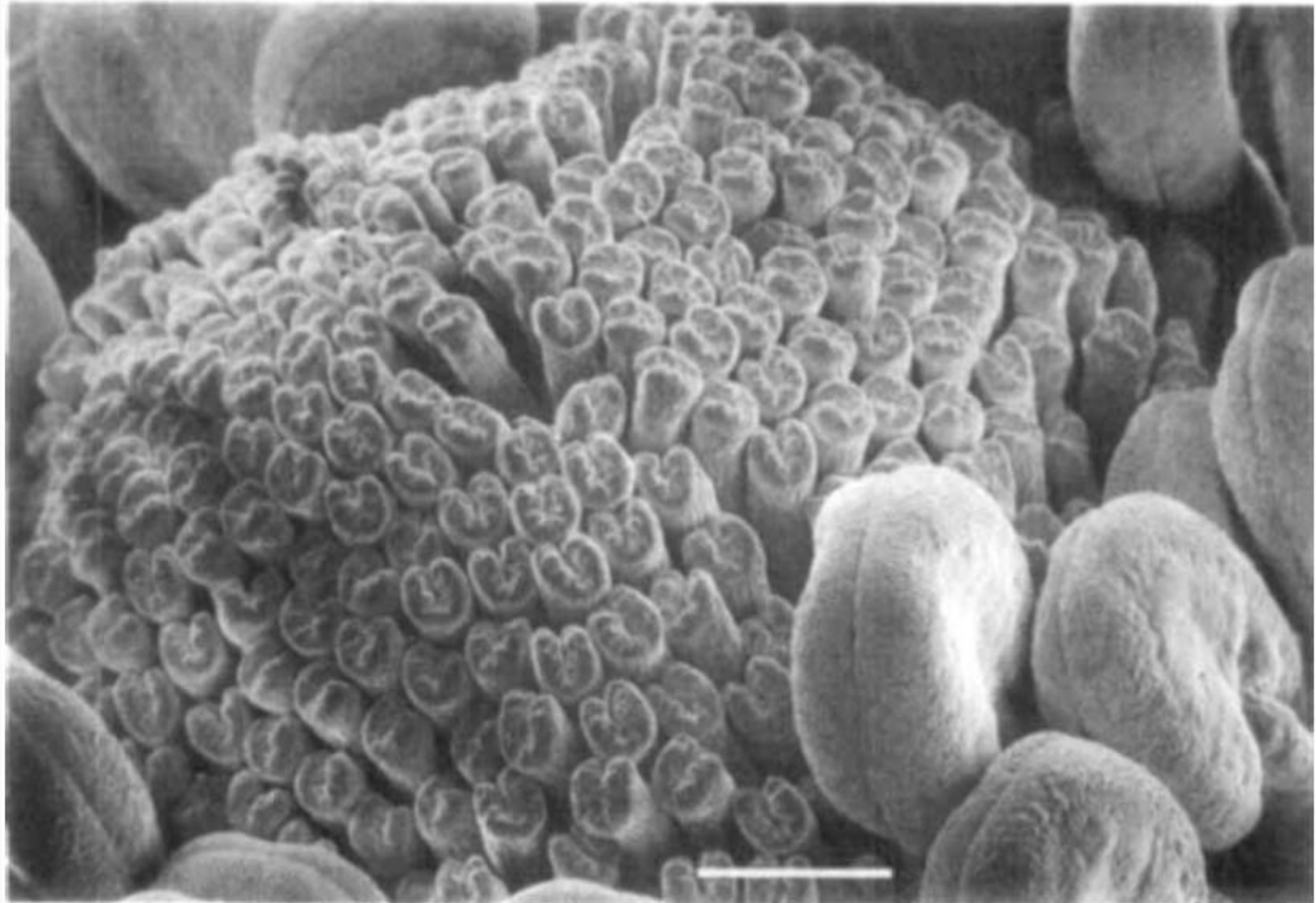


Fig. 9. Differentiation of the stigmas and styles is now complete, *c.* 40 days post-initiation. (bar = 0.5 mm).

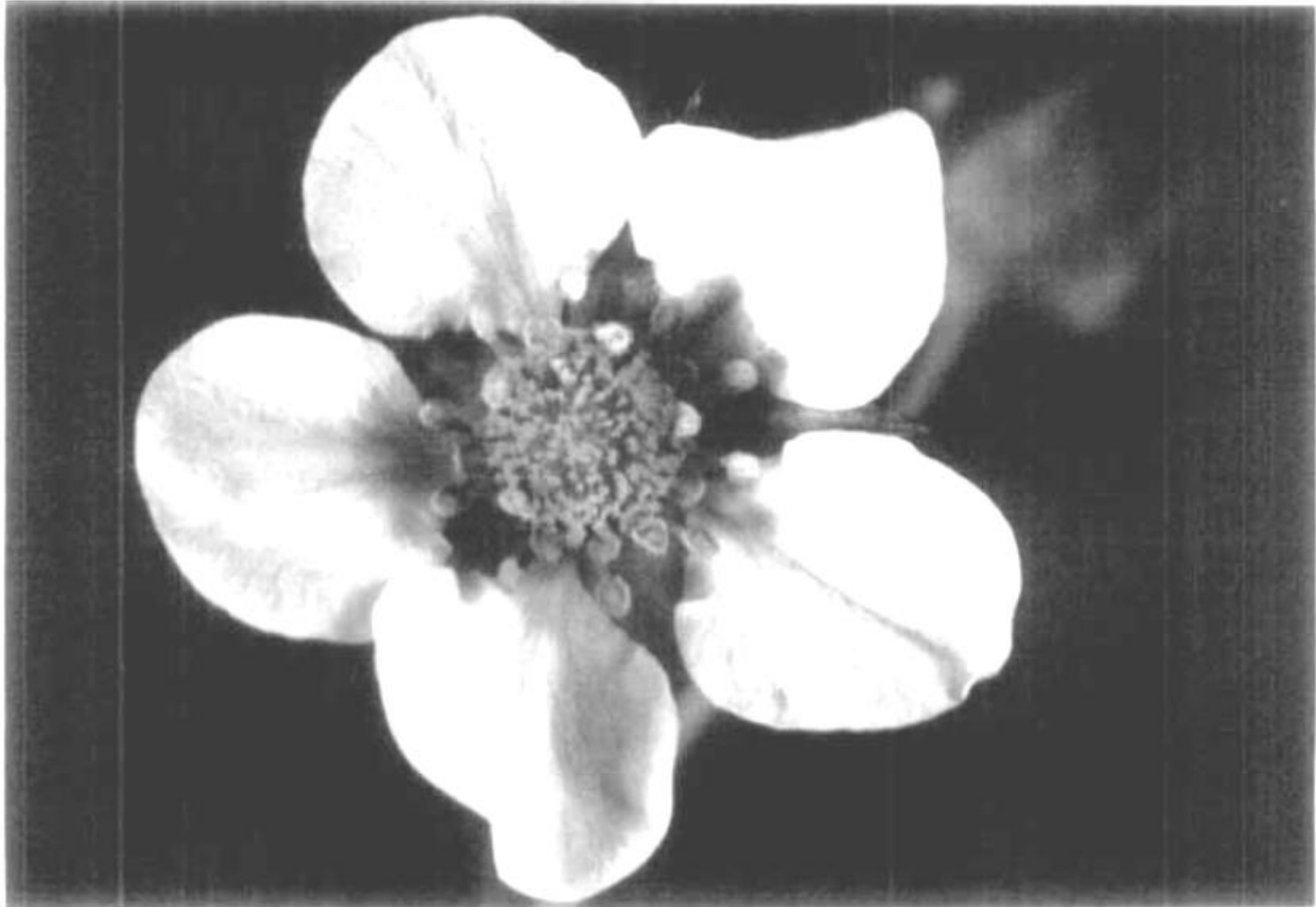
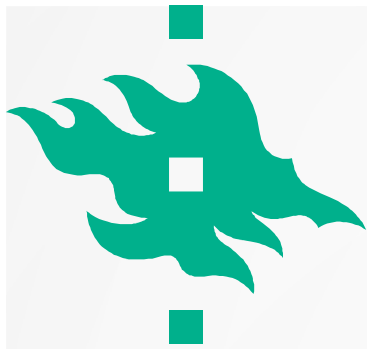
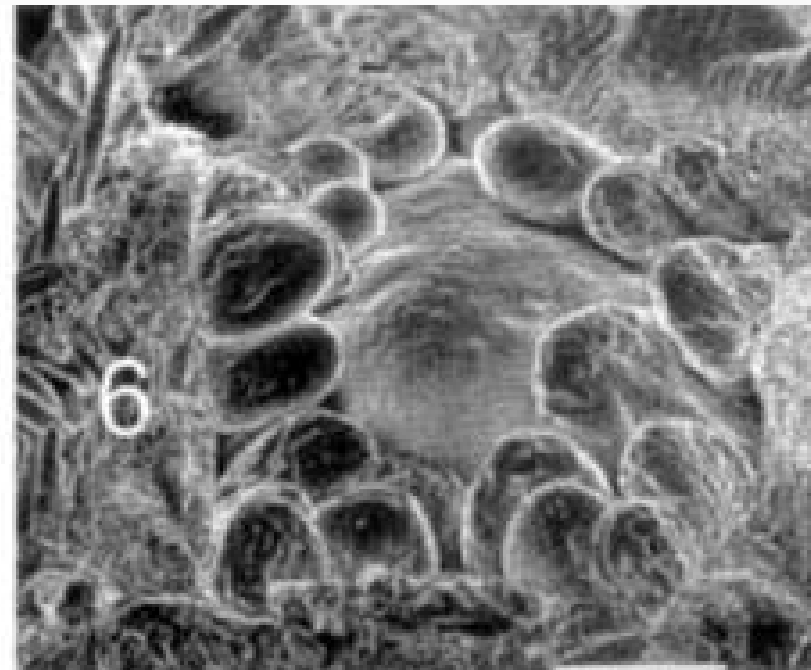
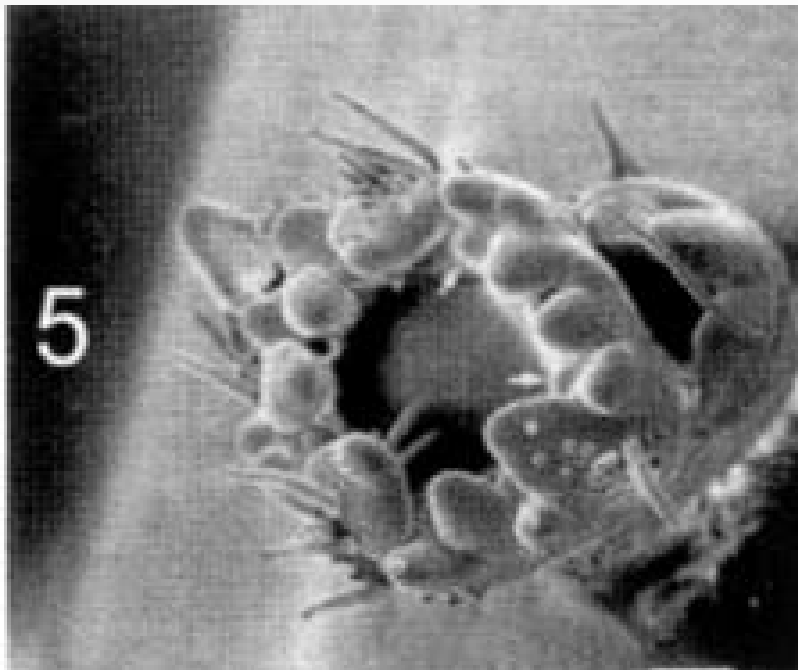


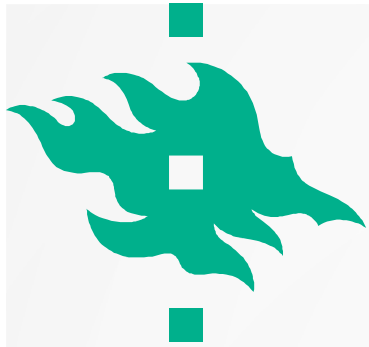
Fig. 11. Mature flower at anthesis.



FLOWER MAPPING

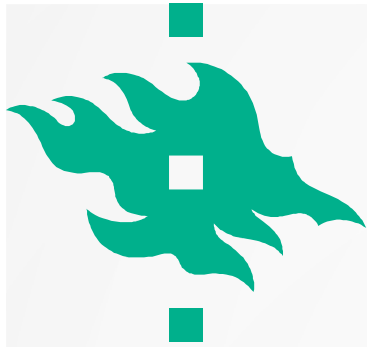
- 6. marraskuuta 2017 kukka-aiheet Etelä-Pohjanmaalla keskimäärin kehitysvaiheessa 6





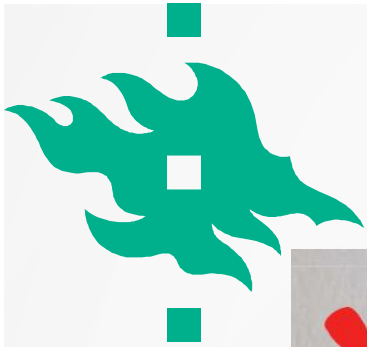
KUKKAVANA- ANALYYSIJÄ TEKEVÄT:

- Planta Logica (<http://www.plantalogica.nl/en/>)
- H.O.R.T. Ancona, Italy ([Strawberry flower mapping](#))
- Muita?

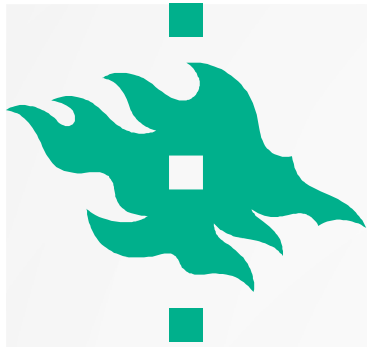


PLANTA LOGICA

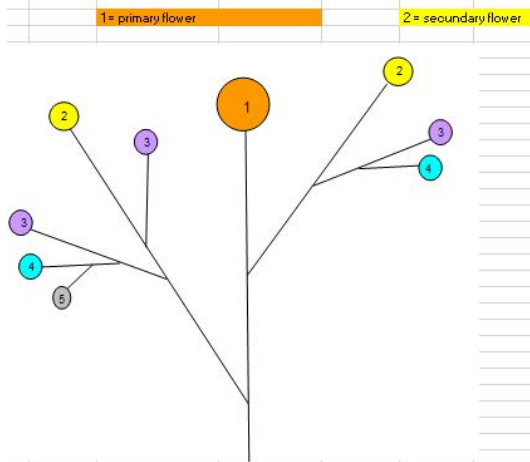
- Top flower mapping
 - Juurakon kärkikukan kehitysaste ja kärkikukinnon pituus
 - Voidaan määrittää kukintainduktion ajankohta (säädä!)
- Total flower mapping
 - Kaikkien juurakon silmujen kehitysaste ja koko



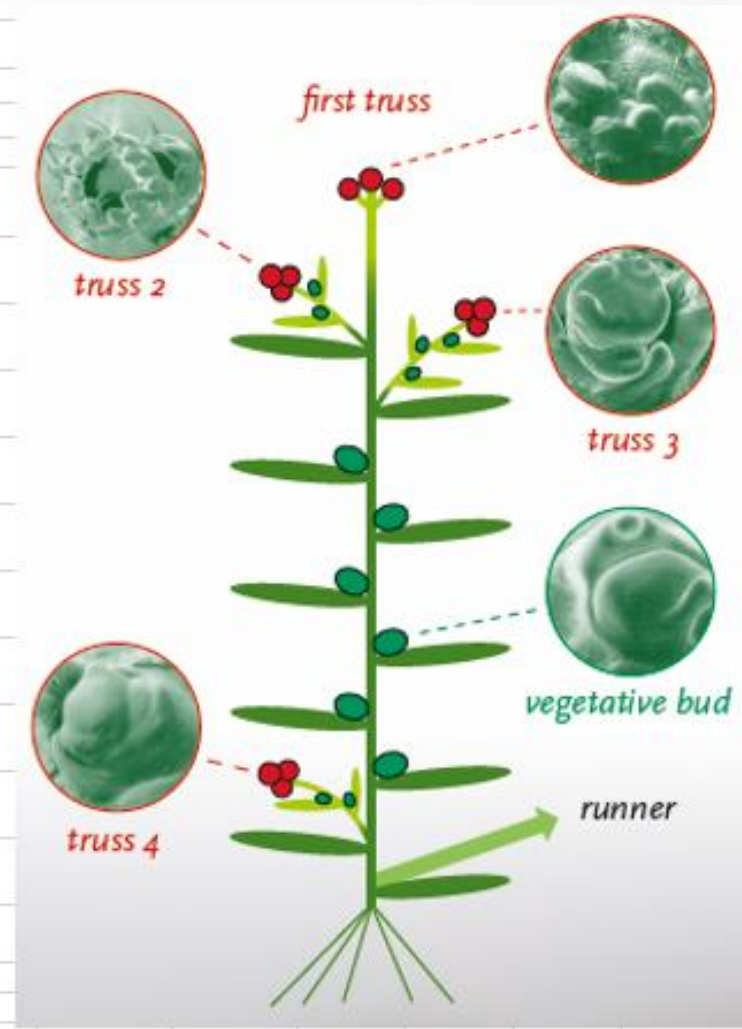
AXILLARY BUDS



FLOWER MAPPING



Position	Development stage
first truss	7
10	5
9	4
8	2
7	2
6	2
5	2
4	2
3	2
2	3
1	R



STRAWBERRY 'FLOWER MAPPING'

Example

Date	Grower	Sample code	Plantnr.	(1= lowest position)			Bud length (cm)			Development stage	Truss length (cm)	Drawing
				Crownnr.	Position	Runner	≥ 1	0.2 - 1	< 0.2			
17.nov.16	PRI	Elsanta	1		first truss				7	0,70	7	
17.nov.16	PRI	Elsanta	1		10			*	5	0,12	5	
17.nov.16	PRI	Elsanta	1		9			*	4	0,08	4	
17.nov.16	PRI	Elsanta	1		8			*	2		2	
17.nov.16	PRI	Elsanta	1		7			*	2		2	
17.nov.16	PRI	Elsanta	1		6			*	2		2	
17.nov.16	PRI	Elsanta	1		5			*	2		2	
17.nov.16	PRI	Elsanta	1		4			*	2		2	
17.nov.16	PRI	Elsanta	1		3			*	2		2	
17.nov.16	PRI	Elsanta	1		2			*	3	0,03	3	
17.nov.16	PRI	Elsanta	1		1	*			R		R	

- 2 = vegetatiivinen
- 3 = generatiivinen?
- ≥ 4 = generatiivinen
- R = rönsy

Date	Grower	Sample code	Plantnr.	Crownnr.	(1= lowest position)		Bud length (cm)			Development stage	Truss length (cm)	Drawing
					Position	Runner	≥ 1	0.2 - 1	< 0.2			
06 November 2017	ProAgria	MY LN1 R20 Polka	1	1	first truss					6	0,25	6
06 November 2017	ProAgria	MY LN1 R20 Polka	1	1	8				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	1	7				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	1	6				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	1	5				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	1	4				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	1	3				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	1	2	*				R		R
06 November 2017	ProAgria	MY LN1 R20 Polka	1	1	1	*				R		R
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	first truss					6	0,22	6
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	12				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	11				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	10				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	9				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	8				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	7				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	6				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	5	*				R		R
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	4	*				R		R
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	3	*				R		R
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	2	*				R		R
06 November 2017	ProAgria	MY LN1 R20 Polka	1	2	1	*				R		R
06 November 2017	ProAgria	MY LN1 R20 Polka	1	3	first truss					6	0,25	6
06 November 2017	ProAgria	MY LN1 R20 Polka	1	3	11				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	3	10				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	3	9				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	3	8				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	3	7				*	2		2
06 November 2017	ProAgria	MY LN1 R20 Polka	1	3	6				*	2		2
												26
											0,06	4
											30/8/2018	
												4

Paulina Palonen

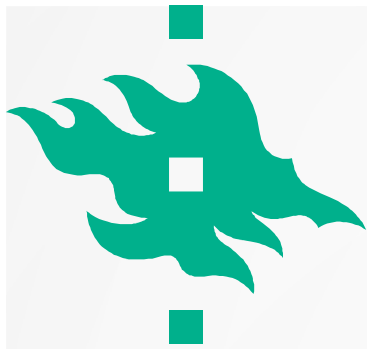
30/8/2018



KUKKAVANA-ANALYYSIN TULKINTA

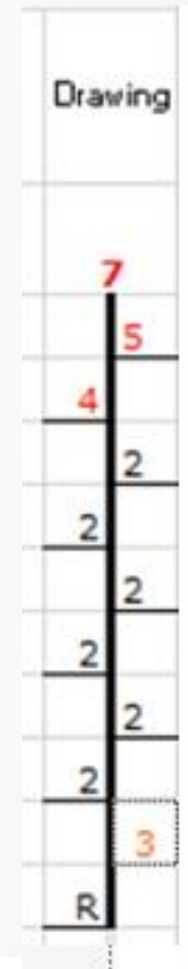
- Kukinnan puhkeamiseen vaikuttaa:
 1. Kehitysaste
 2. Kukinnan aiheen sijainti juurakonhaarassa
- Juurakonhaaran kärkikukinnolla ja kahdessa ylimmässä hankasilmussa olevilla kukinnonaiheilla on parhaat mahdollisuudet puhjeta ja kasvaa satoa tuottaviksi kukinnoiksi.
- Todennäköisimmin puhkeavat kukinnot pitkälle kehittyneissä silmuissa (> 1 cm)
- Alempien hankasilmujen kukinnonaiheet saattavat myös puhjeta satoa tuottaviksi kukinnoiksi
 - riippuu kasvuolosuhteista ja kasvin satorasituksesta
- Parhaat mahdollisuudet alemmissa hankasilmuissa on pisimmälle kehittyneillä kukinnonaiheilla (pisimmät (cm) ja korkea kehitysaste).





KUKKAVANA-ANALYYSIN TULKINTA

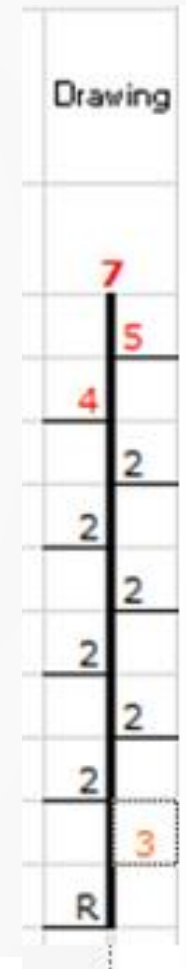
- **Kukinnonaiheiden lukumäärä**
- -> ennustaa satopotentiaalia
 - Realisoitunut kukintojen määrä kasvia kohti riippuu kukintojen kehitysasteesta ja kasvuolosuhteista.





KUKKAVANA-ANALYYSIN TULKINTA

- **Kukka-aiheiden kehitysaste**
- → ennustaa kukinnan ja sadontuoton aikaisuutta, ajoittumista ja satokauden pituutta
 - Suuret kehitysasteessa ennustavat sadontuoton eriaikaisuutta -> Sadontuotto jakaantuu pidemmälle aikavälille.
 - Jos 2. ja 3. kukinnonaiheiden pituudet samanlaisia, sato ajoittuu lyhyelle aikavälille
- Kukinnan pituuden perusteella voi arvioida, kuinka paljon kasvuastetunteja tarvitaan ensimmäisen kukinnan puhkeamiseen (poiminnan alku, etc. ?)

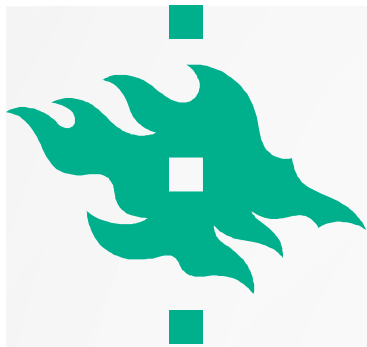




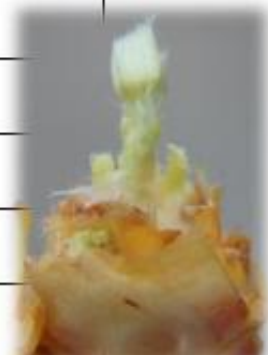

Stadium	GDH	Top flower high (cm)
0		
1		
2		
3	3500	
4	4500	
5	5500	
6	6500	0.2 (Visible for the eye)
	7500	0.3
	8500	0.4
	9500	0.5
	10500	0.6

Nauja Lisa Jensen, Gartneri rådgivningen

Elokuun 2017 keskilämpötila Seinäjoella 14,1° C -> 230 GDH / vrk
-> 1 mm ero kärkikukinnan pituudessa merkitsee 4,3 vrk eroa
kukintainduktion ajankohdassa



Stadium	GDH	Top-flower (High in cm)	Development
6	6500	0,2	Top flower visible for eye
6	7500	0,3	
6	8500	0,4	Start initiation of 2. flower truss
6	9500	0,5	
6	10500	0,6	Start initiation of 3. flower truss
6	11500	0,7	
6	12500	0,8	



Nauja Lisa Jensen, Gartneri rådgivningen