

棉花의 受精現象과 綿毛發生에 關한 研究

放射線農學研究所 韓 昶 烈

圓光大學農學部 李 萬 相

湖南作物試驗場 趙 守 衍

Studies on the fertilization and development of wool hair in cotton

C. Harn, M. Lee and S. Cho

※Office of Atomic Energy, Won Kwang Collge and Honam Crop Experimental Station.

Summary

A study has been made on phenomena of fertilization, hair genesis, and development of such forma of cotton flower as Mok Po 5, Red Leaf, Paymaster, Acala 1517w.

- 1) The pollen occurs to germinat at 4 hrs. after its pollination and reaches the base of style 10 hrs. later, when 18 hrs elapsed, it gets enter at micropyle passes through placenta.
- 2) There may remain only one synergid as another one is occupied by pollen tube when it enters micropyle.
- 3) The fertilization completed at 18-48 hrs. after pollination. It was observed that Mok Po5 is the fastest, somewhat slower in Red Leaf and the slowest is the case of Paymaster in its speed.
- 4) Wool hair is formed by development of daughter cell which is due to epidermal cell division, it starts its way right before blooming.
- 5) Wool hair is the most in its number covering about 60~80 within one hour after pollination and finishes its forming within 4-6 hours. The number is more abundant at basal portion of ovule and later

her at outer surface than at inner one of it.

- 6) The average length of wool hair checked at different time limit is as follows.

2.7~8.3 μ 1 hr after pollination.

43.3~263.7 μ 24~48 hrs. after pollination.

The growth speed both of Mok Po 5 and Red Leaf get nearly same value but Paymaster is somewhat slower in its speed.

緒 言

棉花 또는 그 近緣植物에 對하여 細胞學的 發生學的 및 受精現象과, 綿毛發生等에 關하여는 近世紀初以來 많은 研究報告가 있다. 三原(1919)는 授粉後 6-9時間이던 子房에 花粉管이 珠孔에 達하여 受精이 終了한다고 하였고, 8) Gore(1932)는 授粉後 15-20 時間이던 花粉管이 子房에 들어가며 24-30時間이던 受精이 完了된다고 하였고, 地毛는 表皮細胞의 分裂에 依하여 생긴 娘細胞가 伸長하는 것인데 開花後 24時間이던 表皮細胞의 約80%가 發生하며 48時間이던 全部 發生하여 綿毛의 伸長은 開花25-30日이던 完了된다고 하였다. Harland(1936)는 Haploide에 對하여 染色體數 13으로 genome을 形成하였다는 研究報告가 있는데. 今般 著者들은 우리나라에서 栽培하고있는 綿花 4品種에 對하여 受精現象과 綿毛의 發生 및 發育過程을 調査하였는바

干的 結果를 얻었기에 報告하는 바이다.

材料 및 方法

材料는 木浦5號, Red leaf, Paymaster Acala 1517W 를 作物試驗場 木浦支場으로 부터 分讓받아 移植栽培 하여 7月19-20日에 人工授粉後 時間別로 採取 Carnoy 液에 固定하고 Paraffin 包埋한것을 10-20 으로 連續 切片을 만들어 Heidenhains iron-alum haemafoxylin 染色을 하였고 縮毛의 기리는 Micrometer로 胚珠의 內側 外側 또는 上部, 中央, 基部로 나누어 測定하였다.

結果 및 考察

受精現象

Table 1 The number of daughter cell after pollination

Variety			Pollination					
			1 hrs	2 hrs	4 hrs	6 hrs	10 hrs	
Mok Po # 5	Ovule	Inner Daughter Cell	U	3.3	2.2	3.2	3.2	4.0
			M	4.6	5.5	7.2	6.8	8.0
			L	6.2	7.2	7.0	7.0	6.2
			T	14.1	15.2	17.4	17.0	18.2
	Ovule	Outer Daughter Cell	U	5.0	5.5	6.2	7.0	5.2
			M	8.0	9.0	6.8	8.5	7.0
			L	5.4	8.5	7.0	7.2	7.5
			T	18.4	23.0	20.0	22.7	19.7
Red Leaf	Ovule	Inner Daughter Cell	U	1.5	1.0		3.5	4.7
			M	6.3	6.0		8.0	6.7
			L	7.0	6.7		7.5	5.3
			T	14.8	13.7		19.0	16.7
	Ovule	Outer Daughter Cell	U	1.8	3.7		4.5	4.7
			M	6.5	7.0		6.5	5.7
			L	5.5	6.7		6.5	5.7
			T	13.8	17.4		17.5	16.1
Paymaster	Ovule	Inner Daughter Cell	U	0	0	0	0	1.5
			M	0.3	3.5	3.5	5.5	3.8
			L	1.2	4.5	3.8	7.3	9.5
			T	1.5	8.0	7.3	12.8	19.8
	Ovule	Outer Daughter Cell	U	0.8	0	2.3	0	2.5
			M	2.8	2.8	5.8	5.8	8.8
			L	1.0	3.5	2.0	7.5	8.8
			T	4.6	5.8	10.1	13.3	20.1

※ The number of daughter cell in 240" (5Rep.)

- U. Upper part
- M. Middle part
- L. Lower part
- T. Total

授粉 4時間이면 花粉管은 柱頭에서 發芽하여 花柱內로 侵入伸長하기 始作하는데 (Fig. 2,3) 花粉粒이나 花粉管은 굵은 便이다. 授粉 10時間이면 花柱의 基部에 達하고 授粉 18時間이 되면 花粉管은 胎座를 거쳐 珠孔에 進入하는 (Fig. 4,5)데 그 時刻는 4品種 거의 같다. 珠孔內에 들어간 花粉管은 媒助細胞를 뚫고 들어가기 때문에 花粉管이 珠孔內에 進入後에는 1個의 媒助細胞만 남는다 (Fig. 6). 이 時期에 雄核이 極核과 融合된 것도 間或있으나 (Fig. 7), 授粉 24時間以後에야 完了되는 듯하다. 授粉當時의 2個의 極核은 比較的 肥大해 있는 便인데 (Fig. 1) 受精後에도 融合은 안되어있다. 授粉 24時間이면 精核은 卵細胞內에 侵入하여 卵核에 精核이 附着한다 (Fig. 8). 이 무렵 初生胚乳核은 分裂을

하여 遊離胚乳核을 形成하기 始作한다 (Fig. 9). 授粉後 受精까지의 時間은 木浦 5號가 가장 빠르고 Paymaster가 가장 늦으며 Red leaf는 그 中間程度이다. 授粉 2日이면 受精은 全部 完了되고 곧 受精卵은 核分裂을 하여 原(前)胚를 形成하기 始作한다 (Fig. 10, 11). 木浦 5號는 거의 全部가 胚囊內에 卵細胞나, 極核에 受精이 되나 Rad leaf는 間或 受精이 안되기 때문에 胚珠가 萎縮되어 있는것이 發見되었다.

綿毛 發生

綿毛는 表皮細胞의 分裂에 依하여 생긴 娘細胞가 伸長하는것인데 開花 2-4時間前에는 表皮細胞가 分裂을 하지않으나 (Fig. 12) 開花直前에서부터 開花와 同時時 表皮細胞가 分裂하기 始作하는데 胚珠의 報部인 合蕊

側의 位置에서 가장 먼저 分裂한다 (Fig. 13) 1. 授粉1時間이면 娘細胞(綿毛) 發生數가 가장 많아 表皮細胞의 60~80%에 達하고 (Fig. 14, 15), 授粉 4-6時間이면 表皮細胞의 거의 全部綿毛가 發生完了된것 같다 (Table 1.), (Fig. 16, 17, 18). 이때 授粉 1-10時間까지 胚珠의 表皮에 發生한 綿毛와 授粉 1-72時間까지 綿毛의 기리를 胚珠의 外側面 上部 胚囊의 珠孔側), 中央, 基部(胚囊의 合點側)와 胚珠의 內側面 上部, 中央, 基部 6個部에서 各各 246 內에서 測定하였는데 合點側과 中央部에 그 數가 많고 다리도 길고 珠孔側은 그 數가 적거나 혹은 없는것이었고 기리도 짧다. 胚珠의 表皮內側面이 表皮內側面보다 數도 많고 기리도 긴 편이다 (Table 2)

Table 2 Development of fibres (daughter cell) after pollination

Variety			Pollination									
			1 hrs	2 hrs	4 hrs	6 hrs	10 hrs	18 hrs	24 days	2 days	3 days	
Mok Po #5	Ovule	length of inner fibres	U	4.0 ^u	6.2	5.0	7.2	15.6	20.6	19.4	40.0	120.0 ^u
			M	11.2	8.1	11.2	13.8	23.8	50.0	88.1	372.4	584.0
		L	6.5	8.1	12.5	13.1	18.3	39.4	83.8	266.7	608.0	
		A	7.2	7.5	9.6	11.4	19.2	36.7	68.8	223.7	437.3	
	Ovule	length of outer fibres	U	7.0	7.5	11.2	11.2	15.0	11.6	37.5	106.7	412.0
			M	1.0	11.2	13.7	13.8	26.3	29.4	71.9	379.0	724.0
			L	5.0	8.8	11.6	13.8	22.5	35.6	71.9	245.3	604.0
			A	7.3	9.2	12.2	12.9	37.5	25.5	60.4	243.6	580.0
Red Leaf	Ovule	length of inner fibres	U	5.0	4.2		8.8	11.7	13.1	16.7	56.0	260.0
			M	12.5	9.2		11.3	29.2	56.9	77.8	376.0	832.0
			L	7.5	10.0		11.3	31.7	41.9	86.7	304.0	732.0
			A	8.3	7.8		10.5	24.2	37.3	60.4	245.3	530.0
	Ovule	length of outer fibres	U	3.8	7.5		7.5	14.2	15.6	30.8	108.0	320.0
			M	11.3	13.3		12.5	35.0	56.2	50.0	408.0	840.0
			L	8.8	11.7		10.0	28.3	26.2	67.7	275.0	756.0
			A	8.0	10.0		1.00	25.8	32.7	49.5	263.7	639.0
Paymaster	Ovule	length of inner fibres	U	0	0	0	0	4.4	6.9	2.5	68.0	70.4
			M	0.6	5.0	4.4	14.4	13.8	43.1	26.2	208.0	268.8
			L	1.3	8.1	5.0	15.6	23.8	40.6	101.2	364.0	236.8
			A	0.6	4.4	3.1	10.0	14.0	30.2	43.3	213.0	192.0
	Ovule	length of outer fibres	U	0.6	0	7.5	3.8	4.4	8.8	3.8	56.0	70.4
			M	3.8	5.0	7.5	6.9	14.4	36.2	43.1	208.0	230.4
			L	3.8	8.8	4.4	11.9	13.8	33.1	85.6	368.0	262.4
			A	2.7	4.6	6.5	7.5	10.9	26.0	44.2	210.7	187.7

- ※ U. upper part
- M. Middle part
- L. Lower part
- A. Average

또한品種別로 보면發生初期는木浦5號나Red leaf가數도 많고기리도 길며 Paymaster는數도 적고기리도 짧다. 그러나發育함에 따라 그數는 거의 같다. 平均綿毛長은授粉1時間이면 2.7~8.3'',授粉18~24時間이 되면極核에精核이進入하는時期인데 平均綿毛의 기리가 25.5~68.8''이며 (Fig. 19) 授粉24~48時間이 되면卵核에精核이進入하는時期인데綿毛의 기리가 43.3~263.7''의 까지發育한다 (Eig. 20, 21). 胚珠의內側面에는綿毛가發生하지 않은것도間或있고發生하더라도外側面에 비해 짧은便이다 (Eig. 22, 23, 24).

摘 要

우리나라에서栽培하고 있는棉花品種木浦5號, Red leaf, Paymaster, Acala 1517w等에對하여受精現象과綿毛發生 및發育에關해서比較調査하였다.

- (1) 花粉은授粉4時間後부터發芽伸張하고,授粉10時間이면花柱의基部에達하고授粉18時間이면胎座를거쳐珠孔에進入한다.
- (2) 花粉管이珠孔에進入할때는1個의媒助細胞를뚫고들어가기때문에受精後에는1個의媒助細胞만남는다.
- (3) 授粉18~48時間이면受精이全部完了되는데木浦5號가빠르고Paymaster는늦으며Red leaf는그中間이다.
- (4) 綿毛는表皮細胞의分裂에依하여생긴娘細胞가伸長하는데開花前부터始作한다.
- (5) 綿毛는授粉後1時間에發生數가가장 많아約60~80%이고4~6時間에거의完了되는데胚珠의上部보다基部에 많고內側面보다外側面에 많다.
- (6) 平均綿毛長은授粉1時間이면 2.7~8.3'',授粉4~48時間이 되면 43.3~263.7''伸長하는데木浦5號, Red leaf는伸長速度가 거의 같고 Paymaster는 늦은便이다.

參 考 文 獻

- (1) Banerji, I. 1929. Studies in Cotton Pollen. Agr. Jour. India 24:332~340
- (2) Beasley, J.C. 1940. Hybridization of American 26-Chromosome and Asiatic 13-Chromosome Species of *Gossypium*. Jour. Agr. Res. 60:175~182
- (3) Brown, H.B. 1938. Cotton, New York
- (4) Gore, U.R. 1932. The development of the female gametophyte and embryo in Cotton. Amer. Jour. Bot. 19: 795~807
- (5) Hagerup, O. 1944. On fertilization, Polyloidy and haploidy in *Orchis maculatus* L. Dansk. B. ot. Arkiv 11(5):1~26.

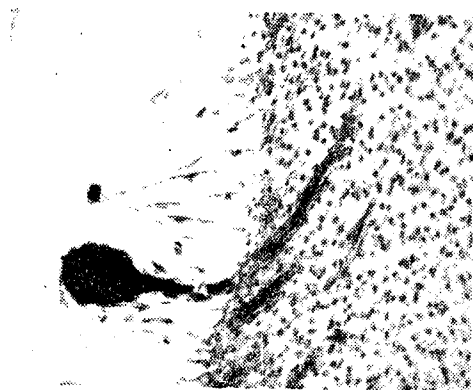
- (6) Harland, S. C. 1936. Haploids in Polyembryonic Seeds of Sea Island Cotton, Jour. Hered. 27:229~231.
 - (7) Iyengar, N. K. 1938. Pollen-tube Studies in *Gossypium*. Jour. Genet. 37:69~106
 - (8) 三原新三, 1919. 棉花學
 - (9) Nicholson, G. E. 1960. The Production, History, Use and Relationships of Cotton (*Gossypium* spp.) in Ethiopia, Econ. Bot. 14
 - (10) 西川五郎, 1962. 作物大系, 第10編 纖維類雜草料類, 養賢堂, 東京 1~9
 - (11) 西川五郎, 1950. 綿毛 및 綿毛의 發育에 關한 作物學의 研究
 - (12) Seshadri Ayyangar, G. 1948. Some Observation on Stomata found on Cotton Ovules. Indian Cotton Growing Rev. 2: 187-192
 - (13) Skovstee, A. 1939. Cytological Studies in twin plants. Compto Rend. des Trav. Garlsbery Lab. Ser. Physiol, 22: 427-446.
 - (14) Silow, R. A. and Stephens, S. C. 1944. 'Twinning' in Cotton. Jour. Hered. 35:76-78
 - (15) Webber, J. M. 1938. Cytology of twin Cotton plants. Jour. Agr. Res. 67:155-160.
- Fig. 1 polar nuclei prior to fertilization'
 Fig. 2, 3 pollen tube penetration 6 and 10 hours after pollination;
 Fig. 4 Penetration of pollen tube;
 Fig. 5 Pollen tubepenetration into embryo sac through micropyle 18 hours after pollination;
 Fig. 6 Nuclear division of synergid 18 hours after pollination;
 Fig. 7 Fusion of sperm and polar nuclei begins 18 hours after pollination;
 Fig. 8 Fusion of sperm and egg nucleus 24 hours after pollination;
 Fig. 9 Division of primary endosperm nucleus 24 hours after pollination;
 Fig. 10, 11 Pro-embryo 2 days after pollination;
 Fig. 12 Epidermis 2-4 hours before blooming;
 Fig. 13 Division of epidermal cells;
 Fig. 14, 15, 16, Wool hair 1-2 hours after pollination;
 Fig. 17 Wool hair 4 hours after pollination;
 Fig. 18 Wool hair 10 hours after pollination;
 Fig. 19 Wool hair 18 hours after pollination;
 Fig. 20, 21 Wool hair 24 hours after pollination;
 Fig. 22, 23 Wool hair 2 days after pollination;
 Fig. 24 Wool hair 3 days after pollination;



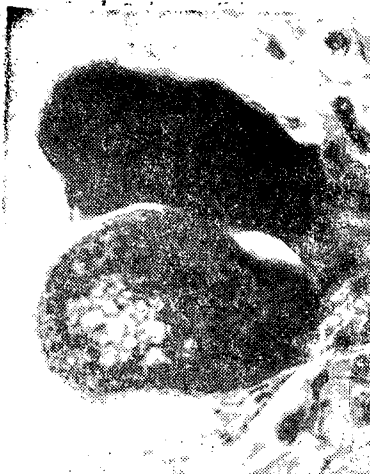
< Fig 1 >



< Fig 5 >



< Fig 2 >



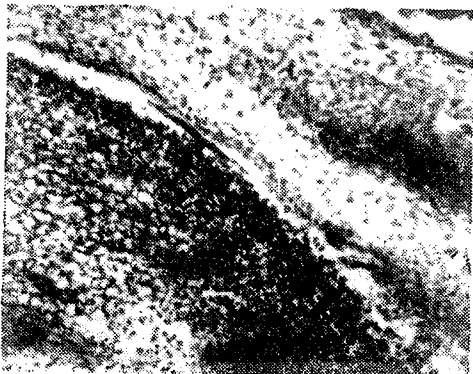
< Fig 6 >



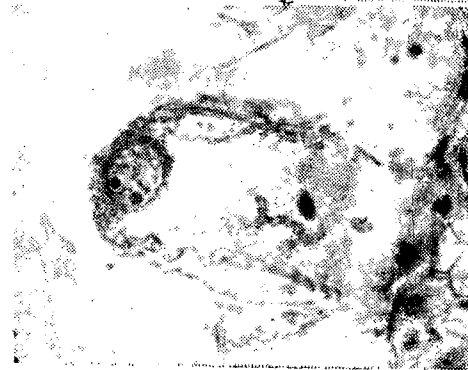
< Fig 3 >



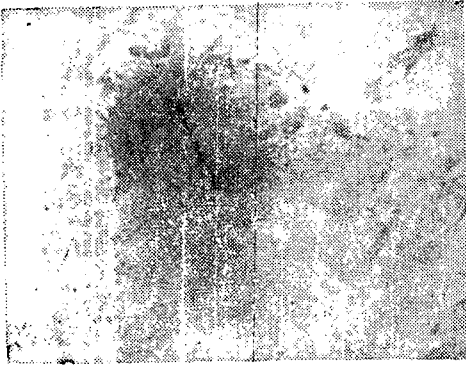
< Fig 7 >



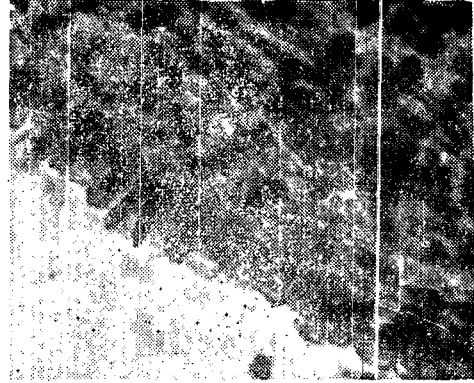
< Fig 4 >



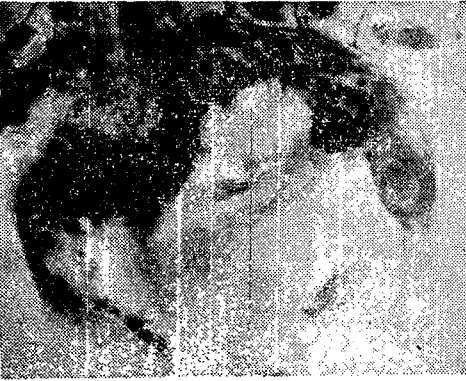
< Fig 8 >



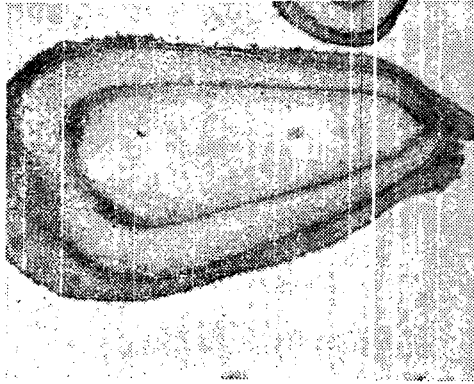
< Fig 9 >



< Fig 13 >



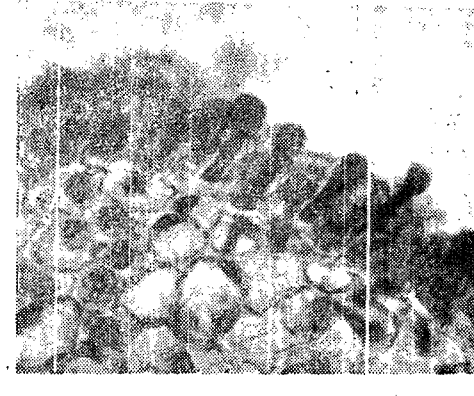
< Fig 10 >



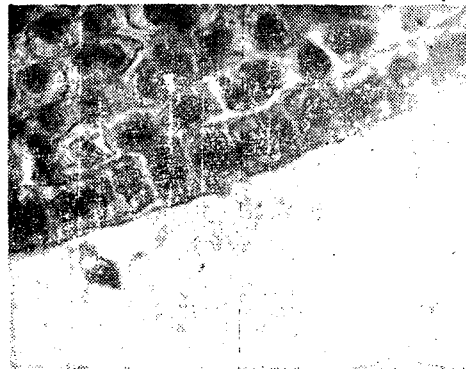
< Fig 14 >



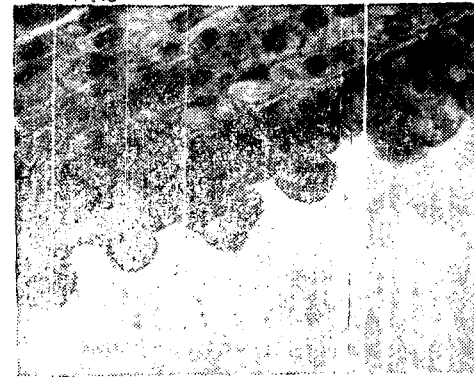
< Fig 11 >



< Fig 15 >



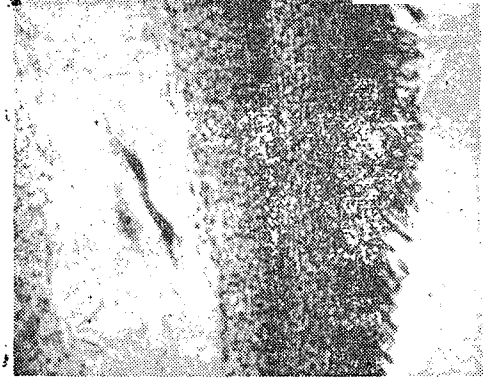
< Fig 12 >



< Fig 16 >



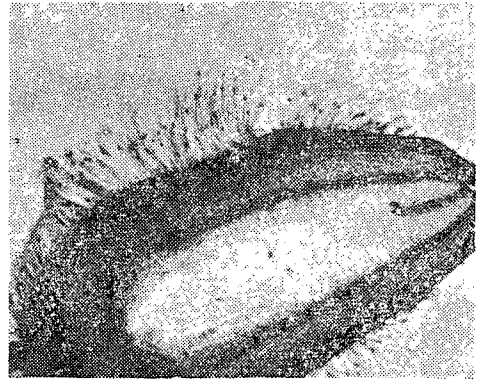
< Fig 17 >



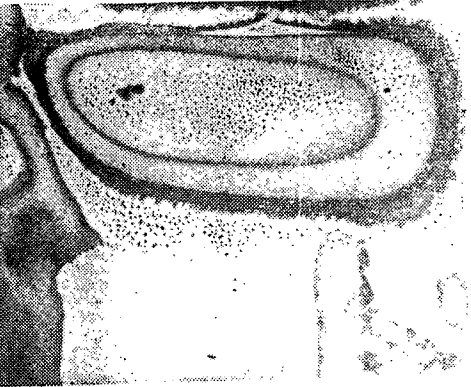
< Fig 21 >



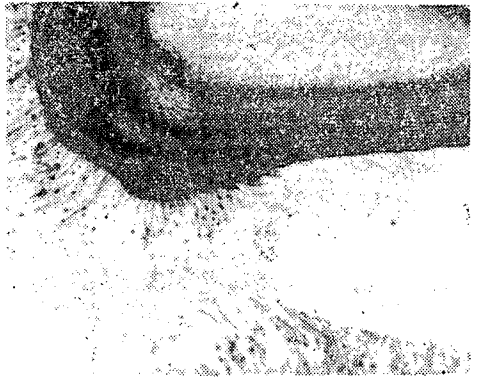
< Fig 18 >



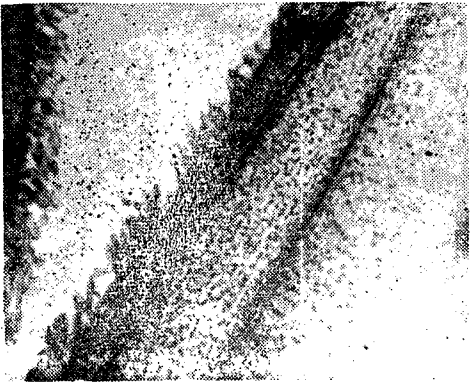
< Fig 22 >



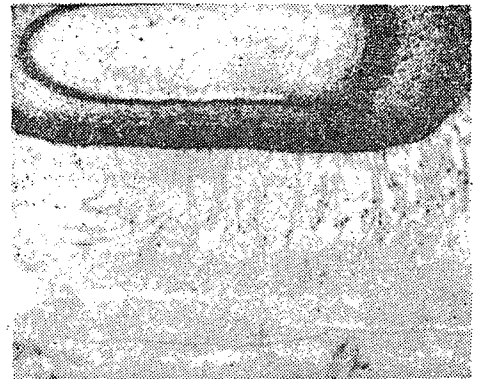
< Fig 19 >



< Fig 23 >



< Fig 20 >



< Fig 24 >