農業研究

③

內　容

卵重與孵化率之關係……李　登　元……1

龍眼殼單寧之研究……駱　承　庠……7

臺灣省十字花科蔬菜害蟲田間藥劑防治試驗報告…陶家駒、陳履通、陳貴華……15

胡瓜露菌病之發生及防除試驗……孫守恭、簡和順……31

季節與區域對於留熱病抗病性之變異（英文）……橋岡良夫……39

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卵重與孵化率之關係

李　登　元

據 Dunn (1932)、Haynes (1925) 與 Axelsson (1932) 先後報告稱：大蛋與小蛋之孵化率均比較中等蛋重者爲差。Landauer (1937) 稱：卵重有影響孵化率的事實。按渠觀察的結果，大卵有減低孵化率之趨勢，但有些觀察者則認爲小卵比大卵之孵化率爲高。Godfrey (1936) 報告稱：總卵重與孵化率及總蛋白質重與孵化率均有顯著的關係。Rudyand Marble (1939) 報告：卵殼的乾重，卵黃重與孵化率沒有相關，但總卵重與孵化率則爲顯著的負相關。據 Scott and Warren (1941) 報告卵之總重量，卵之各部份的重及其各重量之關係情形，所得的結論爲各群大卵之孵化率均較低，在其1936年資料中以小卵之孵化率較高，而在1939年資料中，則以小卵之孵化率較低；並稱卵白約二倍於蛋黃者之孵化率，比蛋白或蛋黃之比例較大者爲高；雞隻所產之卵重大於體重3.95%者，其孵化率較其卵佔體重小於3.95%者爲低。

關於蛋重與孵化率之關係，參考前著者的文獻。蛋重者其孵化率較低，是所公認的事實。至於小蛋之孵化率則有稱高或低的兩種說法。關於這個問題就本所現有四品種雞進行孵化，試驗，三年結果，分析討論如下，以供參考。

材料與方法

本試驗以臺灣省農業試驗所種雞計白色來航、洛島紅、蘆花及名古屋等四品種之蛋爲孵化材料。試驗從1948年10月開始迄1951年 6月止。茲分1948年10月至1949年 7月，1949年10月至1950年 7月及1950年10月至1951年 6月三個年份。按各品種孵化之受精卵計算其孵化率，其蛋重稱至小數點一位（計算時以四捨五入）。蛋重50克以下與61克以上者各歸爲一組，其餘則以每一克爲一組，分別計算各蛋重之孵化率及蛋重與孵化率相關。同時並就三年中各品種蛋孵化成績之結果，分析比較上項試驗四品種在臺北孵化率的高低。

孵化有精蛋數1948—1949計白色來航4279枚，洛島紅879枚，蘆花890枚，名古屋1009枚，1949—1950計來航4267枚，洛島紅665枚，蘆花315枚，名古屋825枚。1950—1951計來航2770枚，洛島紅520枚，蘆花311枚，名古屋394枚。

結果及討論

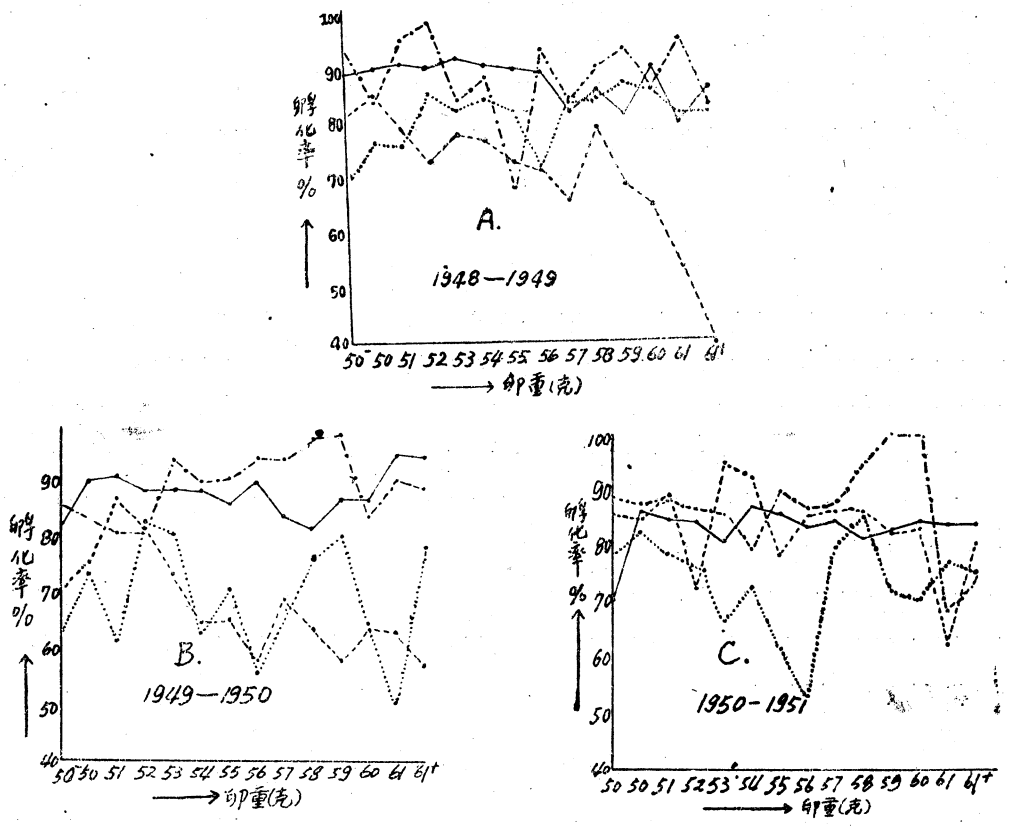
各年度各品種不同卵重之孵化率情形則如圖 A. B. C. 所示。在圖 A. 除蘆花代表曲線有向上之情形外，其他三品種均因卵之增重而有孵化率降低的趨勢。且以名古屋蛋之重量增大其孵化率下降之負相關尤爲顯著，$r=-0.801\pm0.031$。來航與洛島紅之相關係數依次爲 $r=-0.459\pm0.015$ 與 $r=-0.257\pm0.033$ 而爲顯著的負相關。然而蘆花 $r=+0.081\pm0.040$ 爲正相關，但不明顯。在圖 B. 中來航 $r=-0.057\pm0.015$，名古屋 $r=-0.638\pm0.034$ 負相關均爲顯著。蘆花 $r=-0.061\pm0.055$，但表示不

明顯，洛島紅爲正相關 r＝＋0.041±0.038 亦不明顯。 在 1950—1951 年之資料如圖 C 所示，除洛島紅爲不明顯的正相關外r＝＋0.008±0.043，其他品種如來航、名古屋、蘆花等三品種均爲負相關，其相關係數依次爲 r＝－0.017±0.019， r＝－0.062±0.050 及 r＝-0.131±0.056，但不顯著。

三年資料之中卵重與孵化率的關係，來航及名古屋均爲負相關，而僅 1950—1951年的資料表示不顯著而已。而洛島紅1948—1949年資料，乃表示顯著的負相關，其餘兩年的資料，則表示爲正相關，但不顯著。蘆花 1949—1950 年及 1950—1951 兩年的資料爲負相關， 1948—1949 則爲正相關，亦不顯著。關於蘆花、洛島紅在三年資料中分別有正相關而不明顯。這或因此兩種試驗蛋數較少的緣故。總之，以上資料大部份分析之結果，均爲負相關而有明顯的表示，這點事實與 Rudy and Marble (1939) 的報告總卵重與孵化率爲負相關相符合。

雌卵重與孵化率爲負相關，但在圖 A, B, C, 亦可看出卵重在 50 克以下者一般的孵化率比較中等重量爲低，故卵之過小其孵化率亦不佳。

各品種蛋重與孵化率之關係圖



註： 1. ————代表來航，……代表名古屋，－－－－－代表洛島紅，……代表蘆花。
2. 50－表示卵重在50克以下者，61＋表示卵重在61克以上。

上項四品種各年度平均蛋與平均孵化率如表一，據淺野秀雄(1943)在臺灣北部孵化率之統計報告：來航每年平均爲 76.21%，名古屋每年平均爲 71.81%。本試驗三年平均孵化率來航爲 86.879±0.019%，名古屋70.017±0.178%，洛島紅 86.009±0.119%，蘆花爲77.445±0.115%，孵化率以來航爲最高

，洛島紅次之，蘆花又次之，以名古屋爲最低。換言之，卽蛋用種之平均孵化率較之兼用種平均之孵化率爲高。兼用種中則以洛島紅之孵化率爲最高，幾與來航相等。至於各品種三年的蛋重平均來航爲54.836克，名古屋爲56.150克，洛島紅爲56.005克，蘆花爲54.980克。

表一　各品種平均蛋重及其孵化率

品種	平均					
	1948——1949		1949——1950		1950——1951	
	卵重(克)	孵化率(%)	卵重(克)	孵化率(%)	卵重(克)	孵化率(%)
來航	53.909±0.053	83.704±0.133	54.093±0.051	91.586±0.076	56.159±0.151	83.682±0.041
名古屋	55.655±0.124	69.177±0.410	56.408±0.134	65.333±0.275	56.918±0.204	81.218±0.381
洛島紅	56.319±0.148	86.461±0.240	56.923±0.135	88.571±0.186	54.325±0.160	86.923±0.055
蘆花	54.828±0.365	80.112±0.161	54.571±0.237	73.333±0.135	55.807±0.235	73.954±0.451

茲將三年來品種間孵化率之差異情形以變量分析法整理如表二：

表二　各品種間之孵化率變量分析表

變異原因	自由度	平方和	均方和	F值	1%	5%
品種	3	594.70	198.23	6.16*	9.78	4.76
年份	2	6.81	3.40			
機誤	8	193.09	32.13			
總計	11	794.61				

* 表示顯著

由上表可知品種間之孵化率差異顯著，茲再進行各品種間孵化率之比較列如表三。差異顯著所需差數標準爲11.334，差異極顯著所需差數標準爲17.170。

表三　各品種間孵化率之差異比較

品種	總和	平均	差數		
來航	263.972	87.991			
洛島紅	261.955	87.318	0.673		
蘆花	227.399	75.799	12.192	11.519	
名古屋	215.723	71.909	16.082	15.409	3.890

～～～爲差異顯著之標記。

由上表結果，得知各品種間孵化率，來航與洛島紅差異不顯著，而蘆花與名古屋間差異亦不明顯。但來航與洛島紅較之蘆花及名古屋之差異達顯著程度。由此可見各品種間孵化率的差異或因種性、環境或其他因子的關係而不能以品種與品種之卵重互相比較。

摘　　要

1. 卵重與孵化率的關係，三年資料中來航及名古屋均爲負相關，而1950—1951年的資料表示不顯著而已，洛島紅1948—1949年資料乃表示顯著的負相關，而其餘兩年則爲正相關，但不明顯。蘆花除1948—1949年爲不明顯的正相關外，其餘兩年亦均爲負相關，關於蘆花洛島紅在三年的資料中分別有正相關，而爲不明顯。此或因該兩品種參加試驗數目較少的緣故。然而資料之大數分析的結果，均爲負相關且有顯著的表示。此卽各品種之卵愈重，其孵化率有愈低的趨勢。

2. 卵重在50克以下者一般的孵化率亦不佳。

3. 卵用種（來航）的平均孵化率較兼用種（洛島紅、名古屋、蘆花等）的平均孵化率爲高，平均孵化率來航爲86.879±0.019，洛島紅爲86.007±0.119，蘆花爲77.445±0.115及名古屋爲70.017±0.178，兼用種中以洛島紅孵化率爲最高，蘆花次之，以名古屋爲最低。以變量分析法分析孵化率差異情形之結果，表示四品種間之孵化率差異顯著，各品種孵化率的差異，似不能以品種間卵重來解釋而爲環境之適應或其他因子的關係。

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THE RELATION OF TOTAL EGG WEIGHT TO HATCHING POWER

T. Y. Lee

SUMMARY

Hatchability was studied in relation to the total egg weight for four breeds such as S. W. Leghorn, Rode Island Red, Barred plymouth Rock and Nagoya (Japanese breed), from October 1948 to June 1951. From the data the following results were obtained.

1. Either Leghorn or Nagoya showed a negative correlation for each of three years significant in the lst and the 2nd year but insignificant in the 3rd year. The negative correlation indicated that the larger the egg size the smaller the hatchability.

2. The three year data of hatching power of Rode Island Red showed a significant negative correlation in the first year and insignificant positive correlation in the following two years, of Barred plymouth Rock showed a significant negative correlation in the lst and the 2nd year, but insignificant in the 3rd year.

3. However. Figure A. B & C indicated that the egg size below 50gms. by weight had, in general, a decreasing tendency in hatchability.

4. The hatching power of Leghorn breed exceeded that of general purpose breeds. The hatchability of Leghorn was 86.879±0.019 percent. That of Rode Island Red, of Barred Plymouth Rock and of Nagoya were 86.007±0.119, 77.445±0.115, and 70.017±0.178 per cent respectively.

The analysis of variance among the hatchability of the four breeds showed a significant difference : The F value was 6.16(1%=9.78. 5%=4.76).

龍眼殼單寧之研究

駱　承　庠

本文承農林公司前技術室主任賈伊箴先生及本所技正鄭謀平先生校正特此誌謝

龍眼俗稱桂圓，盛產於華南一帶，每屆收穫季節，或供生食，或以加工，果殼盡棄於地，未加利用，幾如垃圾，徒勞清除之煩。本室有鑒於此，遂設法利用，知其中含有單寧成分，似可供鞣革之用。僅就其單寧含量言，雖未盡合理想，但其產量極豐，且採集便利，在極度缺乏鞣劑之我國，或可稍補漏巵於萬一。本研究之動機即在於此。

（一）龍眼殼單寧之抽浸及分析：

本項試驗之目的，在求龍眼壳中單寧對抽出溫度及時間之影響，以求出在何種溫度及時間之下，可使其所含單寧高度抽出。

（I）試驗材料：本試驗所採用之材料，因其種類不同，故單寧含量亦異：一種壳色較黑，一種壳色較赤，本文暫以壳色較黑者名爲黑壳，壳色較赤者名爲赤壳，該項果壳係購自臺南縣產地加工所，因限於經費，未能收集大量新鮮龍眼親自剝壳處理，故其中單寧含量難免因醱酵有所變化，故本試驗所得之單寧含量，僅可謂較低之數字。

表一　供試材料之成分

種　類	水　分（%）	單　寧（%）	非　單　寧（%）	不溶成分（%）
赤　壳	14.5712	2.6145	8.7788	62.6422
黑　壳	13.8286	3.0505	10.1394	59.7516

（II）試驗方法：

1. 不同溫度對龍眼壳單寧抽出量之影響：

溫度不同對抽出量之影響頗大，茲以 60°C 至 100°C 分成五組，抽出其含量，並分析其結果，列表如下：

表二　不同溫度處理後單寧含量之變化表

溫　度	種　類	水　分(%)	可溶性成分(%)	非單寧成分(%)	單　寧　分(%)	不溶成分(%)
60°C	赤　壳	13.1135	8.0765	6.5017	1.5748	73.8331
	黑　壳	13.1724	10.4333	8.0825	2.3508	65.9510
70°C	赤　壳	12.9835	9.1066	7.3097	1.7096	68.8033
	黑　壳	12.3057	10.9666	8.6430	2.3770	65.7070

80°C	赤　　壳	13.1341	9.3600	6.9047	2.4553	68.1459
	黑　　壳	12.5627	11.2349	8.3323	2.9026	64.9775
90°C	赤　　壳	12.9647	10.5120	7.9078	2.6042	66.0113
	黑　　壳	12.5201	12.7560	9.7546	3.0014	61.9859
100°C	赤　　壳	14.5712	11.3933	8.7788	2.6145	62.6422
	黑　　壳	13.8286	13.1899	10.1394	3.0505	59.7916

由上表觀之，龍眼壳單寧含量，在100°C以內時與抽出溫度成正比，卽溫度愈高單寧抽出量愈多，但自80°C以上，單寧含量雖微有增加，却並不顯著，而非單寧成分則激增，由此可以決定，抽出溫度以80°C至90°C之間最爲適宜。

2. 抽浸時間不同對龍眼壳單寧含量之影響：

抽浸時間不同，對龍眼壳含有物之溶解度大有出入；茲將處理情形及其結果列表如下：

表三　不同時間處理後龍眼壳單寧含量之變化表

時　間	溫　度	種　類	水　分 (%)	可溶性成分 (%)	非單寧分 (%)	單　寧　分 (%)	不溶成分 (%)	備　　註
半小時	90°C	赤　壳	13.1670	8.8100	6.3641	2.4459	69.2130	分三次抽出每次各10分鐘
		黑　壳	13.2458	10.6733	7.9766	2.6967	65.4036	
1 小時	90°C	赤　壳	13.5672	9.9899	7.3960	2.5939	66.4530	分三次抽出第一次30分第二次第三次各15分
		黑　壳	13.3068	11.2166	8.1891	3.0275	64.2600	
2 小時	90°C	赤　壳	13.9680	10.7432	8.0802	2.6631	65.5454	分三次抽出第一次1小時第二次第三次各30分
		黑　壳	13.6701	11.9466	8.9344	3.0033	63.4366	
3 小時	90°C	赤　壳	13.7934	11.7666	9.2488	2.5178	62.2734	分三次抽出第一次1.5小時第二次1小時第三次半小時
		黑　壳	13.3199	13.9666	11.0887	2.8779	58.7469	

由上表觀之，抽出時間，自1小時以後，時間增長單寧分反有減少趨向，雖則可溶性分隨時間加長而增加，而可溶性非單寧成分之增加反較單寧成分之增加爲速，因此單寧成分有逐漸減少趨向，所以最適宜的抽浸時間不得超過1小時，過長不僅枉費勞力與費用，且有使單寧質變劣之趨勢；半小時以下則因單寧成分未能全部抽出，故亦非所宜。

（Ⅲ）　結論：

1. 抽浸龍眼壳單寧時，溫度以80°C爲最適宜。
2. 抽浸龍眼壳單寧時，時間以30分至1小時爲最適宜。

（二）龍眼殼單寧精製造試驗：

本項試驗，係根據以上所得之時間與溫度兩種因子，將龍眼壳之抽出液，濃縮製成固體單寧精，而考慮濃縮時下列各因子，對於單寧成分之影響：

1. 濃縮溫度對單寧之影響。
2. 濃縮時間對單寧之影響。

3. 眞空濃縮之效用。

（I） 試驗材料：

本試驗係採用上述黑壳爲試驗材料，因黑壳較赤壳單寧含量爲多，其他性質則大致相同，爲方便計僅取黑壳而作供試材料，其成分如表一。製造單寧精時，所用抽出液，係利用普通自來水，在90°C～100°C分三次浸出，第一次半小時，第二第三次各15分鐘，其浸出液混合於一個容器中，共用龍眼壳51kg，抽得浸出液 62.3kg，爲避免釀酵，將全部浸出液煮沸五分鐘，然後貯於滅菌缸中，以備逐漸取用，其組成爲：

表四 龍眼壳抽浸液之組成

水分（%）	單寧（%）	非單寧（%）	不溶成分（%）
94.3271	1.8371	3.3173	0.5180

（II） 試驗方法：

本試驗根據上列三種因子，用各種不同處理製成單寧精，然後分析製品之單寧成分，以作比較。單寧分析法係根據1928年萬國公定單寧定量法施行，定量時所用之皮粉，爲本研究室製造者，其成分如下：

水分（%）	可溶性物（%）	灰分（%）	PH
18.93	0.74	0.55	6.00

茲將單寧精製造時，應用各種處理法，列表如下：

表五 單寧精製造時各種處理表

試驗號數	浸出液用量（kg）	濃縮溫度（°C）	蒸發用具	攪拌與否	備註
1	3.000	93°*	二重銅鍋	有	
2	3.000	92°	二重銅鍋	有	
3	3.000	92°	二重銅鍋	否	
4	6.000	92.5°	二重銅鍋	否	
5	3.000	91°	二重銅鍋	否	
6	1.500	90°	二重銅鍋	有	
7	1.500	76°	二重磁鍋	否	二層鍋之內層磁製，外層銅質，二層之間加水。
8	3.000	80°	二重磁鍋	有	
9	3.000	85°	二重磁鍋	否	
10	3.000	69°	眞空二重鍋	否	
11	3.000	70°	眞空二重鍋	否	
12	3.000	71°	眞空二重鍋	否	
13	3.000	99°	直火二重鍋	有	二層間不加水。
14	3.000	100.5°	直火一重及二重	有	先用一重鍋，待濃縮至相當程度後再用二重鍋。
15	1.500	101°	一重銅鍋	有	

* 濃縮溫度以濃縮過程中，保持時間最長之溫度爲標準。

蒸發濃縮用具計分四種：（一）爲內磁外銅之二重鍋上加玻璃罩，罩頂連通抽氣機，並插一溫度計。（二）爲內外皆銅質之兩層鍋。（三）爲內磁外銅之二層鍋。（四）爲銅質單層鍋，直接加熱於鍋底。除（一）之外其餘皆開口。

取用浸出液時，每次在取用前，先攪拌均勻，取出後再密蓋容器，以防水分蒸發，濃度改變。濃縮時間如以 3kg計算，則二層銅鍋約需10小時，內磁二重鍋約需19小時，眞空二重鍋約需15小時。濃縮完畢並冷却後，將單寧精移裝於密閉廣口瓶中，以備分析成分。

（Ⅵ） 試驗結果：

茲將各種方法製成之單寧精列表如下：

表六　單寧精產量表

試驗號數	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
浸出液用量(kg)	3.000	3.000	3.000	6.000	3.000	1.500	1.500	3.000	3.000	3.000	3.000	3.000	3.000	3.000	1.500
單寧精產量(kg)	155	165	170	325	165	85	85	170	170	185	190	180	165	165	85
單寧精量/浸出液用量(%)	5.2	5.5	5.7	5.4	5.5	5.7	5.7	5.7	5.7	6.2	6.2	6.0	5.5	5.5	5.5

茲將製成之單寧精成分列表如下：

表七　單寧精成分表

試驗號數	水　分(%)	固形分(%)	可溶性分(%)	不溶成分(%)	單　寧　分(%)	非單寧分(%)	非單寧/單　寧
1	5.6734	94.3266	79.9710	14.3556	28.5920	51.3790	1.7970
2	12.8907	87.1093	76.5714	10.5379	26.9684	49.6030	1.8393
3	8.4137	91.5863	80.7713	10.8150	28.1769	52.5944	1.8666
4	9.9848	90.0152	76.7142	13.3010	26.2054	50.5088	1.9274
5	9.4374	90.5626	78.7142	11.8484	26.3507	52.3635	1.9872
6	12.9732	87.0268	78.0571	8.9697	27.6871	50.3700	1.8893
7	12.0018	87.9982	80.2857	9.7125	27.3563	52.9294	1.9348
8	12.6170	87.3830	75.7200	11.6630	25.4100	50.3100	1.9799
9	12.5637	87.4363	76.4285	11.0078	26.0976	50.3309	1.9285
10	13.0874	86.9126	78.2571	8.6555	28.1165	50.1406	1.7833
11	15.8824	84.1176	76.4285	7.6891	27.2639	49.1886	1.8058
12	15.6672	84.3328	76.5142	7.8186	27.2494	49.2648	1.8079
13	8.1985	91.8015	80.0000	11.8015	28.4742	51.5258	1.8095
14	9.3364	90.6636	74.2857	16.3779	24.2655	50.0202	2.0614
15	15.0919	84.9081	71.7145	13.1936	23.1425	48.5720	2.0988

茲再將表七之分析數值，以乾物量計算，其成分之百分率列於下表：

表八　單寧精乾物成分及濃縮時間表

試驗號數	單　寧(%)	非 單 寧(%)	不溶成分(%)	非單寧/單寧	濃縮時間(小時)
1	30.3117	54.4693	15.2190	1.7970	9.5
2	30.9593	56.9434	12.0973	1.8393	9
3	30.7654	57.2573	11.8085	1.8666	11.5
4	29.1122	56.1114	14.7763	1.9274	29.3
5	29.0967	57.8202	13.0831	1.9872	11
6	31.8144	57.8787	10.3068	1.8193	4.5
7	30.3965	58.8116	10.7918	1.9348	12.5
8	29.0789	57.5741	13.3469	1.9799	18.5
9	29.8246	57.2075	12.5895	1.9285	19.5
10	32.3503	57.6908	9.9588	1.7833	15
11	32.3831	58.4759	9.1408	1.8058	14.5
12	32.3117	58.4171	9.2711	1.8079	15
13	31.0171	56.1274	12.8554	1.8095	7
14	26.7643	55.1274	18.0644	2.0614	4
15	27.2559	57.2054	15.5570	2.0988	2.5

Ⅳ　討論：

1.　關於溫度對單寧之影響：

茲將各種溫度對單寧濃縮之影響列表比較如下：

試驗號數	溫　度 (°C)	單　寧 (%)	非 單 寧 (%)	非單寧/單寧
10	69	32.3503	57.6908	1.7833
11	70	32.3831	58.4759	1.8058
12	71	32.3117	58.4171	1.8079
14	100.5	26.7643	55.1274	2.0614
15	101	27.2559	57.2054	2.0988

由上表觀之，以高溫濃縮時，單寧成分有顯著減少之傾向，此或係龍眼壳單寧對熱之抵抗較弱，高溫能使單寧成分變質。再自非單寧與單寧之比率觀之，其比率隨溫度之增高，有顯著增加之趨向，故亦可斷定，單寧成分因受熱之影響變爲溶解性非單寧成分，由此可以證明，製造龍眼壳單寧精時，以低溫可得較佳之結果。

2.　濃縮時間對單寧之影響：

茲將各種不同時間處理所得結果列表比較如下：

試驗號數	濃縮時間（小時）	單　　寧（%）	非　單　寧（%）	濃縮時取樣（kg）
6	4.5	31.8144	57.8787	1.500
13	7.0	31.0171	56.1274	3.000
3	9.0	30.7654	57.2573	3.000
8	18.5	29.0789	57.5741	3.000
9	19.5	29.8246	57.2075	3.000
4	29.3	29.1122	56.1114	6.000

由上表觀之，單寧成分隨濃縮時間之增長而減少，此或係濃縮時因久與空氣接觸而使單寧變質，故製造單寧精時，濃縮時間應盡量縮短，使單寧成分不致因時間增長而減少。

3. 眞空濃縮之效用：

試驗號數	蒸發用具	單　　寧（%）	非　單　寧（%）	非單寧 / 單寧
1	二重銅鍋	30.3117	54.4693	1.7970
2	二重銅鍋	30.9593	56.9434	1.8393
3	二重銅鍋	30.7654	57.2573	1.8666
4	二重銅鍋	29.1122	56.1114	1.9274
5	二重銅鍋	29.0967	57.8202	1.9872
6	二重銅鍋	31.8144	57.8787	1.8193
7	二重磁鍋	30.3965	58.8116	1.9348
8	二重磁鍋	29.0789	57.7741	1.9799
9	二重磁鍋	29.8246	57.2075	1.9285
10	眞空二重鍋	32.3503	57.6908	1.7833
11	眞空二重鍋	32.3831	58.4759	1.8058
12	眞空二重鍋	32.3117	58.4171	1.8079
13	直火二重鍋	31.0171	56.1274	1.8095
14	直火一重及二重	26.7643	55.1274	2.0614
15	一重銅鍋	27.2559	57.2054	2.0988

由上表觀之，眞空二層鍋（10,11,12, 三組）所濃縮之單寧精，其單寧成分比任何其他各組爲高，可見眞空濃縮之效用極大，故製造單寧精時，眞空濃縮可得優良之結果。

V. 結論：

1. 龍眼壳單寧對熱不安定，以低溫濃縮可得較佳之結果。
2. 龍眼壳抽出液中，非單寧含量較多，純度較低，故可用於初期鞣製，以減低收斂性。
3. 濃縮時間應盡量縮短，以免單寧發生變化，使成分減低。
4. 製造單寧精時，眞空濃縮可得優良之結果。

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附註：1. 本試驗時所用之單寧分析方法係根據1927年國際公定第三次單寧分析方法施行。

2. 單寧精利用部份正在進行中，待續報。

A STUDY OF TANNIN IN THE PERICARP OF LONGAN

By

C. H. Loh

Summary

Longan (Nephelium longana, Camb) is a native fruit tree in south China. The pulp is edible, while the pericarps were thrown away as rubbish, the quantity of which is considerable. In order to utilize this wasted part, the writer made an analysis of the pericarp and found that it contains tannin which may be used for tanning leather. Further study was made on the properties of tannin contained in it. The study consists of following two steps:—

I. Extracting and analyzing of the tannin of the pericarp of Longan.

II. Refining of the tannin extracted from the pericarp of Longan.

The experimental results are summarized as follows:

1. The optimum temperature for extracting tannin from the pericarp should be 80°C.

2. The duration of soaking is considered to be most favorable between 30-60 min.

3. Since the tannin thus extracted from the pericarp is thermo-unstable, lower temperature must be used during condensing procedure.

4. The extract solution showed comparatively high Non-tannin contents low degree of purity. It can be, therefor, used for head liquor tannin to save shrinkage.

5. To avoid any chemical change of tannin, which may result a loss of tannin, the duration of condensing procedure should be shortened as much as possible.

6. The best result has been obtained when a vacuum condenser is used for condensing the extracted solution.

臺灣省十字花科蔬菜害蟲田間藥劑防治試驗報告

陶家駒　陳履通　陳貴華

臺灣省之十字花科蔬菜種類與其他各省相同，計有土白菜、結球白菜、芥菜（青菜）、甘藍、花菜、蘿蔔等種。過去情形，除土白菜、花菜種子等外，其餘種子大部（甘藍、蘿蔔）或全部（結球白菜），由外省運來，現在則由日本供給。因本省冬春二季氣溫過高，且北部多陰雨，不宜採種；夏秋栽培，亦因高溫多雨，感覺困難；除生長期較短的土白菜和蘿蔔外，概難栽培，但此時栽培土白菜和蘿蔔，蟲害亦烈。

本省之十字花科蔬菜害蟲，與其他各省相同；但廣布世界的小粉蝶，大陸之大葉蟲，未見出現，堪爲幸運。大陸爲防治此等害蟲，小粉蝶在甘藍栽培上，大葉蟲在白菜及蘿蔔栽培上，增加成本不少，故以後防止此等菜蟲之侵入，在本省植物檢驗事業上，非常重要，應加注意。澳洲區的菜螟，廣布全島，爲害甚烈，爲本省十字花科蔬菜害蟲中的特色。

防治菜蟲之方法固然很多，但由於市場四季需要蔬菜以及勞力土地經濟利用關係，多不以輪作方法減免蟲害。蛾類幼蟲多行人工捕殺，蚜蟲則以魚籐根浸出液防治之。防治用具最簡單的方法，爲用毛筆或稻草帚蘸撒藥液，或利用自行車之打氣筒及輪胎之零件所製成的噴霧器，與日製各式噴霧器防治之。

藥劑除採用本省生產的魚籐根外，尚用英商卜內門洋碱公司之愛克（BHC）及日本三井化學工業株式會社之 BHC。而本省出產之DDT、BHC採用不多，此因製造 DDT、BHC之兩工廠，未直接向菜農推廣所致。

本文爲敘述作者等自民國三十八年以來，在臺灣南北兩地，實地作菜田種種防治蟲害試驗之效果，至於以前之紀錄，概不列入，以節篇幅。文中分本省常見之十字花科菜蟲形性概述，田間藥劑防治試驗實錄，田間藥劑防治與環境關係，藥劑與人之衞生問題等等。工作進行中，承前所長湯文通教授，現任所長徐水泉博士，前主任馬駿超先生，現任主任洪踵銓先生及鳳山熱帶園藝試驗分所所長黃弼臣先生之惠予方便，並中國農村復興委員會，臺灣碱業股份有限公司之資助，得以順利進行，謹誌謝忱。

一、臺灣省十字花科蔬菜害蟲種類形性概述

本省之十字花科蔬菜害蟲，據歷年來調查，常見者有下列十六種。

1. 負蠊 Atractomorpha bedeli Bolivar

本種成蟲若蟲體有綠色棕色兩型，成蟲若蟲共同咬食菜葉成大孔，並常排洩堅硬長菱形蟲糞於葉上，一見即知其爲本種爲害。本蟲爲雜食性，除菜類外，尚食煙草等之葉片，爲害程度，並不嚴重，無另行防治之必要。

2. 大菜椿象 Eurydema pulchra Westwood。

本種成蟲若蟲體均有紅黑斑紋，若蟲體扁，初齡若蟲群集一處，吸食部變爲黃白色，如繼續加害，則該部乾枯。成蟲分散，產卵於菜葉下面，常分列兩行，每行五六列，頗整齊，卵粒圓筒形。本蟲發生並不普遍，無另行防治之必要。

3. 桃蚜 Myzus persicae Sulzer

本種成蟲若蟲體色不一，有淡綠、綠、淡紅、淡棕諸色，體光滑，無蠟粉，較扁平。成蟲若蟲共同伏息葉下，吸食菜液，並分泌黏甜露滴，誘發煤病。發生多時，葉片捲縮不展，少時無若何徵狀。本種蚜蟲爲雜食性，本省以爲害煙草爲主，爲害菜時，常與下述之僞菜蚜共棲一處，吸食葉液。防治法爲撒布魚籐精乳劑或魚籐根浸出液，最爲經濟有效。

4. 僞菜蚜 Rhopalosiphum pseudobrassicae Davis

本種成蟲若蟲體淡黃綠色至暗褐色，略被白色蠟粉，體較肥圓，略隆起。本種爲本省菜類最重要害蟲，並爲專食性，除爲害十字花科菜類以外，尚未發現其爲害其他有經濟價值的植物。本種發生每當颱風季節過後，氣候較爲乾旱時最烈，如不設法防治，菜苗每致萎凋枯死。菜農通常於移植時，先將菜苗浸入魚籐根浸出液或魚籐精乳劑後，再行移植之。中南部結球白菜、芥菜常爲第一季或第二季水稻之糊籽作，待水稻收穫後，再行肥培與撒布魚籐等製劑防治工作。此後所種植者，因菜類栽培面積增廣，蚜蟲食料豐富，且天敵如瓢蟲、食蚜虻、寄生蜂等紛至沓來，控制繁殖；北部步入雨季，適宜寄生菌之繁殖，氣溫降低，繁殖漸緩，爲害不如前烈，造成自然平衡狀態。

5. 菜蚜 Brevicoryne brassicae Linne

本種成蟲若蟲體密被蠟粉，體較長圓，小形，亦爲專食性，但在本省分佈，並不普遍，其發生後爲害之程度，並不亞於僞菜蚜，通常爲害甘藍，亦可用魚籐精防治之。

6. 小葉蟲 Phaedon brassicae Baly

本種成蟲爲光黑色甲蟲，胸背及翅鞘光滑，翅鞘有點刻列，以別於大陸長江黃河兩流域諸省之大葉蟲，卵橙黃色，光滑，分別半埋於菜葉下面葉脈組織內，以別於產卵於地上或葉上成堆的大葉蟲。幼蟲黑色，有肉瘤，肉瘤之上有毛。成蟲幼蟲共食菜葉，點點成孔。幼蟲老熟後，入土化蛹，蛹亦作黃色。本種成蟲幼蟲一遇驚動，常縮足捲體落地。本省因慣用砒酸鉛防治之，故不成大害，南部似未發現，中北部偶有出現，爲害之菜葉，往往不堪供食。

7. 黃條葉蚤 Phyllotreta vittata Fabricius

本種成蟲光黑色，兩翅鞘各有金黃色略呈彎曲兩端較粗之縱條，後足腿節特別膨大，善跳，故名。卵產於地中根上，幼蟲土棲，食根，成蟲剝食菜葉，點點成斑，概不穿孔。被害之菜，停止發育，組織變老，不適食用，幼苗時期爲害，每致枯死。本種專食性，爲本省夏秋季之主要蔬菜害蟲。蓋夏秋季節高溫豪雨，除果菜類、根菜類及生長期短之葉菜類土白菜可以栽培外，其他蔬菜概難栽培，而生長期短之土白菜及蘿蔔，黃條葉蚤爲害特烈。如不防治，每致無收，故凡栽培土白菜者，必用BHC粉劑，可濕性粉液防治之。本省中、南、東諸部以春季爲害最烈，北部以夏秋爲害最烈，長期雨季可阻止本蟲之發生，乾旱則促成大害。本種成蟲在中南部尚剝食甘藍、花菜等種莢，以致不能採種，近已應用 BHC, DDT 等粉劑防治之。

8. 黑點粉蝶 Pieris canidia sordida Butler

本種幼蟲體綠色，有黑點及細毛，背線粗，呈鮮黃色，以別於大陸爲害菜類最烈之小粉蝶。幼蟲食葉成缺刻，並排洩綠色糞粒於葉上，老熟後化蛹於葉上，蛹兩端尖，胸有角狀突起，胸及尾端有絲固着，成蟲爲白色之蝶，後翅外緣各脈之末端有黑色鱗斑，以別小粉蝶。卵分產於葉下，橙黃色，檸檬形，有縱橫隆起。本種專食性，發生不多，無另行防治之必要。

9. 菜螟 Crocidalomia binotalis Zeller

本種幼蟲綠色，背線及亞背線乳白色，或有粗大褐色側線，群食蘿蔔或甘藍葉片，常吐絲張網，並排洩綠色軟糞於其間，老熟後入土結白色疏繭，化蛹其中，成蟲黃褐色，前翅有銀白色圓紋二個，卵產於葉下，乳白色，數粒至數十粒，排成魚鱗狀。本種幼蟲又剝食莖皮或蛀食種莢內，故又爲主要之採種害蟲，除爲害菜類外，又食萵苣之葉，可撒布砒酸鉛、砒酸鈣、DDT、BHC防治之。應用 DDT或 BHC 防治者，並可兼治蚜蟲，免發煤病，亦可赤手捕殺之。本種爲本省特有之菜蟲，屬澳洲區相。

10. 菜心螟 Oebia (Helluda) undalis Fabricius

本種幼蟲體淡綠色，有褐色縱線五條，專食性，蛀食心葉，粗大葉脈及地上根露出部分內，蟲糞堆積孔外，被害葉片之上部或心葉萎凋，一見即知爲本種所害的特徵。老熟後吐絲綴糞，化蛹其中，成蟲灰黃色，前翅內外緣有波狀紋，上方有眼狀紋，卵分產於心葉上。本種幼蟲爲夏秋蘿蔔之主要害蟲，又蛀食種莢，冬春時爲害菜種極烈，菜農除用手捕殺外，別無良法防治之，尙不知應用砒酸鉛、砒酸鈣、DDT、BHC 等防治之，深爲可惜。

11. 菜蛾 Plutella maculipennis Curtis

本種幼蟲體小，綠色或黃綠色，兩端細小，善跳動，常蛀食心葉，每致不能結球，或剝食一面表皮及葉肉，不能穿孔，老熟後結紡錘形網狀疏繭，化蛹其中，成蟲爲灰褐色小蛾，前翅後緣有黃白色波狀紋，卵分產葉下。本種爲害程度，次於菜螟、菜心螟，可撒布砒酸鉛、砒酸鈣、DDT、BHC 防治之，或赤手捕殺之。

12. 擬尺蠖 Phytometra ni Hubner

本種幼蟲體大，綠色，前端細小，後端粗大，第三四腹節無腹足，故行走如尺蠖幼蟲，幼蟲食葉成孔，並排洩綠色糞粒於葉上，老熟後結白色薄繭於葉下面，化蛹其中，成蟲灰褐色，胸背鱗毛豎起前翅中間有銀白色斑一個，卵分產於葉下，饅頭形，有縱橫隆起方格，幼蟲爲害程度，僅次於斜紋夜蛾，赤手捕殺或撒布砒酸鉛、砒酸鈣、DDT、BHC 等防治之。此外又與本種相似之同屬擬尺蠖 Phytometra spp. 多種，因形性相似，不再多述。

13. 斜紋夜蛾 Prodenia litura Fabricius

本種幼蟲體色不一，斑紋亦異，皮光滑，初齡幼蟲群集一處，剝食一面表皮及葉肉，長大後分散，蠶食葉片，老熟後，入土化蛹，成蟲黃褐色，前翅有斜走之白色或黃白色紋多條，成蟲產卵成塊，外附黃褐色尾毛，作橢圓形，內有卵數十粒，卵饅頭形，有縱橫隆起方格。本種雜食性，除害菜蔬外，尙食甕菜、葱、芋、甘藷、煙草、田菁等作物。可赤手捕殺或撒布砒酸鉛、砒酸鈣、DDT、BHC 等防治之。

14. 小地蠶 Agrotis ypsilon Rottenburg.

本種幼蟲體灰褐色，無斑紋，皮粗糙，有大小黑點，初齡幼蟲群集一處，食去一面表皮及葉肉，長大後分散，白日潛伏土中，陰天及入夜出食，切斷幼苗，拖入土中食之，或攀登株上食之，老熟後化蛹土中，成蟲黑褐色，前翅外緣有三角形黑紋，排作一二字形。卵饅頭形，有縱橫隆起方格，赤裸，成塊，產於葉上或地上，幼蟲雜食性，喜食幼苗，北部爲春季各種作物幼苗之害蟲，入夏因高溫及豪雨的影響，出現極少。本種爲害蔬菜，並不普遍，除新墾地及接近荒地、山地在春季爲害外，毋須另行防治之。防治方法應在蔬菜種植前，先行除草整地，撒布砒酸鉛、砒酸鈣、DDT、BHC等毒餌殺之，最爲安全可靠。

15. 菜葉蜂 Athalia lugans proxima Klug

本種幼蟲體藍黑色，多橫縐，第一二腹部亦有腹足。幼蟲專食性，食葉成缺口，一受驚動，常捲曲落地。老熟後入土結褐色有光之繭，化蛹其中，成蟲頭黑色，胸腹黃褐色，翅暗褐色，卵分產於葉緣組織內。本種在本省爲害，並不普遍，無另行防治之必要，當撒布砒酸鉛、砒酸鈣、DDT、BHC等防治其他菜蟲時，亦得防治之。幼蟲因有假死性，赤手捕捉較爲困難。

16. 菜潛蠅 Phytomyza atricornis Meigen

本種幼蟲體乳白色，無足，前端尖，後端粗大，潛食葉之組織內，被食部變爲黃白色，蜿蜒曲折若地圖狀。老熟後化蛹其中。成蟲爲灰黑色小蠅，產卵於葉之組織內，孵化後蛀食之。本種雜食性，亦食豌豆、萵苣、茼蒿等葉片，爲害菜類並不見烈，無另行防治的必要。

二、主要十字花科蔬菜害蟲發生與環境之關係

本省十字花科蔬菜害蟲常見者，有上述十六種，但其中普遍成災者，僅有僞菜蛾、黃條葉蚤及蛾類菜螟、菜心螟、斜紋夜蛾、擬尺蠖等六種，此等主要菜蟲常出現於一地區，但其出現前後，爲害程度常因地域、季節、蔬菜種類、品種等不同而有差別。

本省栽培蔬菜地域，多爲人口集中之都市的四郊，尤以不便運輸久貯之葉菜類更爲如此。爲求產品容易銷售，土地及人力充分利用起見，多行連作，分期作，因此，本科蔬菜之害蟲如僞菜蛾、黃條葉蚤、蛾類幼蟲之食料無缺，如遇氣候適順，又不加人力控制，便可釀成大害。

本科蔬菜爲淺根作物，多栽培於灌溉方便之砂質土壤中，不時灌水，以求發育快，組織嫩，品質高，市價好。土棲害蟲如螻蛄、蟋蟀、小地蚤等，極難生存；斜紋夜蛾，亦不易多量發生。故所發生成災之菜蟲，概爲不需土壤化蛹之菜蛾、菜心螟、擬尺蠖諸種，斜紋夜蛾則由鄰地飛來，產卵繁殖爲害，黃條葉蚤另當別論。

結球白菜、芥菜、蘿蔔、甘藍常爲水稻之後作糊籽作，土棲害蟲無法生存，故此時爲害此等菜類最重要之菜蟲爲僞菜蛾。

僞菜蛾爲專食性昆蟲，不論爲第一季第二季作水稻之糊籽作，後作或旱地連作之蔬菜，如遇乾旱，常成大災。故菜農如無魚藤及噴霧器之設備，難能栽培成功。僞菜蛾之爲害嚴重季節，爲每年颱風雨季過後之九、十諸月。

黃條葉蚤幼蟲土棲，卵、蛹亦在土中，土壤排水不良，或逢雨季，概難生存，故在颱風雨季節中，密度大減，觀鳳山民國三十九年三月廿日起至四十年二月底止調查之消長情形與雨量的關係，便可

知之。即在鳳山氣候情形下，以一、二、三、四，四個月乾旱季節中，發生最多，爲害最烈，此時如不防治，難得收穫。而在北部適在五、六、七、八諸月之乾季，爲害最烈。

斜紋夜蛾及菜蛾之發生，先由他處飛來，產卵，卵經數日孵化，初化幼蟲，食量尚小，不若僞菜蚜之一來，即胎生爲害；黃條葉蚤成蟲之一來，咬食子葉等，致菜苗於枯死，令人注意。此等蛾類幼蟲，可用手捕捉，不若僞菜蚜與黃條葉蚤之非用藥劑防治不可。但捕殺費工，收效不大，茲錄二種夜蛾幼蟲在臺北民國四十年第一季作水稻後作甘藍上出現的消長情形，便可知之。

表一　二種夜蛾幼虫出現消長考查（臺北，民國四十年，前作水稻，甘藍）

調查月日	斜紋夜蛾			擬尺蠖*		
	有蟲株數	蟲數	平均每株蟲數	有蟲株數	蟲數	平均每株蟲數
9月5日	—	—	—	—	—	—
10日	—	—	—	—	—	—
17日	2	1	2.00 (0.02)**	—	—	—
24日	64	12	5.33 (0.32)	30	11	2.73 (0.15)
10月1日	52	9	5.78 (0.26)	28	26	1.08 (0.14)
8日	257	25	10.28 (1.29)	95	34	2.79 (0.48)
16日	551	55	10.02 (2.67)	109	58	1.88 (0.56)
22日	737	84	8.77 (3.69)	84	63	1.33 (0.42)
29日	1,196	96	12.46 (5.98)	35	31	1.13 (0.18)
11月3日	584	64	9.13 (2.92)	34	28	1.21 (0.17)
10日	473	76	5.43 (2.37)	23	25	1.12 (0.14)
17日	116	34	3.41 (0.58)	85	46	1.85 (0.43)
24日	57	28	2.04 (0.29)	48	37	1.30 (0.24)
12月1日	4	3	1.33 (0.02)	93	54	1.72 (0.47)

* 擬尺蠖之蛹，未列在內。　　** 括弧內數字，爲有蟲株及無蟲株總計之平均每株有蟲頭數。

觀表一所示，斜紋夜蛾幼蟲在甘藍定植後，至九月十七日開始出現，初期及末期較少，平均每株尚不及一頭，但在十月間平均每株有一頭以上，尤以十月下旬最多，平均每株有五頭以上，擬尺蠖幼蟲較斜紋夜蛾幼蟲出現較遲，蟲數亦較少，平均每株尚不及一頭，由此可知栽培甘藍，如與水稻輪作，尤以種於第一季水稻之後爲佳，因其生長前期，適在雨期，蔬菜害蟲發生較少。

本省栽培之十字花科蔬菜中：蘿蔔、結球白菜、芥菜以僞菜蚜爲害最烈；蘿蔔，土白菜因可於乾旱季節中栽培，故以黃條葉蚤爲害最烈；甘藍、花菜以諸種蛾類幼蟲爲害最多；而黃條葉蚤、僞菜蚜對於甘藍、花菜之爲害，不如土白菜之烈，但在甘藍，花菜採種期間，亦常見爲害嫩莖及種莢。

三、主要十字花科蔬菜害蟲藥劑田間防治試驗

爲使各種十字花科蔬菜，配合吾人終年需要，與專業菜農充分利用勞力及土地起見，同一土地中，如不受氣候支配，均可以栽培之。雖係爲期不過三、四十天至三、四個月之短期作物，而害蟲之發

生，常較其他作物爲烈，故對此項害蟲之處理，實不容忽視。吾人可不必沿用輪作，變更種植期，或其他方法防治，採用藥劑防治，實更爲有效。雖然菜農亦須花費不少藥費人工及噴霧器等，但其所得收入，常較栽培其他作物爲有利，經濟之周轉，亦較爲靈活。

1. 僞菜蛾，菜農常用魚籐根浸出液防治之。此液調製方法，係先將魚籐乾根浸水過夜，次晨用石臼擊出乳白色液體，如此反復行之，直至不能再擊出乳白色液爲止，用布過濾，此濾液卽可用於撒布。調製濃度：通常以魚籐乾根一斤、清水一百斤配合之。於噴後數日觀之，如無效或效力不大，則減少水量，增高濃度，如前調製。魚籐粉液尚未見應用。民國三十九年與四十年，中國農村復興聯合委員會資助臺灣省農業試驗所應用動物系藥劑研究室，製造 3.5 %魚籐精乳劑，二年來達五萬磅，大部用於防治本種蛾蟲及爲害煙草之桃蛾。

應用魚籐精乳劑防治僞菜蛾，較應用魚籐根浸出液，既便利，又可靠，復經濟，菜農莫不歡迎之。其防治僞菜蛾之有效濃度爲六百到八百倍，通常爲七百倍。當僞菜蛾開始出現時，卽行撒布，俟後數日或一星期，再行撒布一次，直至收穫期前不致成災時爲止。假若在移植菜苗期，遇僞菜蛾寄生爲害，則用五百倍魚籐精液浸漬防治之。茲錄應用魚籐精液及其他藥劑防治僞菜蛾之試驗記錄如下。

本試驗藥劑分乳劑及粉劑二項，同於臺北舉行，供試蔬菜均爲蘿蔔（美濃）。乳劑項於民國四十年十月十七日起，每星期施用 3.5 %魚籐精乳劑及25% DDT 乳劑一次，濃度最初均爲一千倍。每次施藥前，調查經處理後之二十株上各株蛾蟲頭數，至防治效力遞減至70%以下時，藥劑濃度增加一倍爲五百倍，詳如表二：

表二　應用魚籐精乳劑及 DDT 乳劑防治蘿蔔蛾蟲紀錄（臺北，民國四十年，十一、十二月）

藥劑種類	倍數	檢查項目	11月7日	11月14日	11月21日	11月28日	12月5日	12月12日
0.5% 魚籐精乳劑	一千倍	每株頭數	5.3	12.9	110.0			
		防治效力	94.02	94.85	65.19			
	五百倍	每株頭數				3.1	9.5	0.2
		防治效力				99.36	98.28	99.86
25% DDT 乳劑	一千倍	每株頭數	136.9					
		防治效力	-35.28					
	五百倍	每株頭數	7.1	—	2.8	0.3	58.4	23.5
		防治效力	99.20	100.00	99.11	99.94	98.43	96.8
對照			88.6	250.3	316.0	431.9	552.7	734.0

粉劑項爲10% DDT 及1% r BHC，於九月十二日起，每星期施用一次，連續施用五次，每次於施藥前，調查各處理後之五十株上（對照二十株）蛾蟲頭數，及其防治效力，詳如表三：

表三　應用DDT、BHC粉劑防治蘿蔔蚜蟲紀錄　（臺北，民國四十年九月、十月）

藥劑種類	檢查項目	9月27日		10月4日	
		有翅蚜	無翅蚜	有翅蚜	無翅蚜
10% DDT	每株頭數	0.12	2.00	0.16	1.40
	防治效力	80.00	96.39	87.69	97.90
1% r BHC	每株頭數	0.10	0.30	0.20	0.22
	防治效力	83.33	99.62	84.62	99.84
對照		0.60	78.85	1.30	77.20

據此次實驗結果，乳劑魚籐精項，在十月全月及十一月中旬以前施用，最適濃度爲一千倍，十一月下旬起，最適濃度爲五百倍。DDT乳劑十月全月爲一千倍，十一月起則爲五百倍，故在臺北氣候情形下，可以3.5%魚籐精乳劑或25% DDT 乳劑稀釋至五百倍，可防治各種十字花科蔬菜蚜蟲。

粉劑項 DDT 或BHC 粉劑亦可防治之，防治效力對無翅者，可達90%以上，但蚜蟲平時食息於葉之下面，如爲匍伏性之蔬菜葉片，下垂接觸土面，施用液劑，尙感不便，如用粉劑，更感棘手，故粉劑雖對蚜蟲有效，在實用上，實難推廣，況粉劑須在幼苗期施用，常有藥害發生。

2. 黃條葉蚤，菜農在 BHC 未輸入前，幼苗初期常用砒酸鉛、砒酸鈣等砒素劑防治之。近收穫期改用魚籐、除蟲菊等製劑防治之。但防治效力，並不理想，幸自民國三十八年七月起，英商卜內門洋鹹公司愛克殺蟲粉輸入，並指導菜農應用防治以來，全省春夏秋因黃條葉蚤之爲害而致使此季之土白菜無法供應之難題，得以解決。主婦們步入菜場所見鮮綠幼嫩可愛之土白菜，概爲經用BHC防治後之產物，茲將應用BHC、DDT防治黃條葉蚤之田間實錄，分述如下。

本試驗在鳳山舉行，供試蔬菜均爲土白菜，分DDT與BHC 用量，及 BHC 殺蟲有效成分多少與用量二種試驗。DDT、BHC用量試驗於民國四十年二月二十五日及三月五日施藥，分10% DDT 及 1% rBHC 二種主處理。每種主處理又分每市畝每次施用二市斤半及五市斤二種副處理。三月四日及十四日調查各經處理後二十株上葉片之長度、濶度及每葉片上所有之蟲孔數，如表四：

表四　BHC、DDT粉劑防治黃條葉蚤用量試驗　（鳳山，民國四十年二、三月）

藥劑及用量＼種類	蟲孔數				葉長 mm.				葉濶 mm.			
	一次	防治效力	二次	防治效力	一次	增加%	二次	增加%	一次	增加%	二次	增加%
1%rBHC每次每市畝2.5市斤	0.30	99.71	4.55	96.38	7.85	142.47	39.72	169.45	5.00	135.87	28.00	160.55
1%rBHC每次每市畝5.0市斤	0.15	98.59	—	100.00	6.71	121.78	28.27	120.61	4.40	119.57	20.77	119.09
10%DDT每次每市畝2.5市斤	4.75	55.60	47.30	62.44	6.90	125.23	36.62	156.23	4.27	116.23	24.22	138.88
10%DDT每次每市畝5.0市斤	1.43	87.38	11.65	90.75	8.09	146.82	44.87	191.42	5.27	143.21	27.79	159.35
對照	10.70	—	125.95	—	5.51	100.00	23.44	100.00	3.68	100.00	17.44	100.00

據表四所示，土白菜於發芽後十日，撒布10%DDT二次，每次每市畝至少五市斤及 1% rBHC二

次，每次每市畝二市斤半，不但可免黃條葉蚤爲害，且經用 DDT或 BHC 後，有促進土白菜生長的現象，可增加葉片之長度達21—91%，濶度至16—61%之多，而葉色之鮮艷，組織之柔嫩，尚爲餘事。

BHC殺蟲劑有效成分多少及用量比較之試驗，於三月七日及十七日施藥，三月十六日及二十五日檢查各處理後十株上之蟲孔數，葉片之長度及濶度，如表五：

表五　BHC有效成分多少及用量防治黃條葉蚤試驗（鳳山，民國四十年）

種類 / BHC成分及用量	蟲孔數				葉長 mm.				葉濶 mm.			
	一次	防治效力	二次	防治效力	一次	增加%	二次	增加%	一次	增加%	二次	增加%
0.5% r BHC每次每市畝2.5市斤	22.90	33.36	109.90	50.71	15.57	150.58	178.09	178.09	51.50	171.04	11.33	151.47
0.5% r BHC每次每市畝5.0市斤	4.35	86.87	31.05	86.07	14.56	140.81	75.24	182.82	51.54	171.17	10.54	140.91
1% r BHC每次每市畝2.5市斤	4.75	85.67	16.75	92.48	16.21	156.77	89.58	220.04	55.32	183.73	11.20	149.73
1% r BHC每次每市畝5.0市斤	2.65	92.00	13.80	92.02	16.77	162.19	83.77	205.77	54.80	182.00	11.00	147.06
1.5% r BHC每次每市畝2.5市斤	10.15	69.38	33.65	84.91	18.71	180.95	83.06	204.03	48.02	159.48	11.96	159.89
1.5% r BHC每次每市畝5.0市斤	3.55	89.29	46.80	79.01	17.52	169.44	76.44	187.77	54.71	181.70	11.60	168.45
對照	33.15	—	222.95	—	10.34	—	40.71	—	30.11	—	7.48	—

據表五試驗結果所示，BHC 殺蟲有效成分以咖嗎（r）含量 1 %最宜，不論對黃條葉蚤爲害蟲孔數之減少，或土白菜葉片之長度及濶葉之增加，均爲最好，用量亦以每次每市畝二市斤半最爲經濟。

3. 蛾類幼蟲，防治蛾類幼蟲的方法，在過去菜農應用砒酸鉛、砒酸鈣防治之，但砒酸鉛、砒酸鈣目下本省尚未製造，而過去日本及美國所供製品，亦將用罄。故應用 DDT、BHC 等有效濃度、次數等等，急待實驗，以便推廣，因而有本試驗之舉行。茲將田間試驗結果記述於下。

本試驗分鳳山、陽明山及新竹三地舉行。供試蔬菜鳳山及陽明山爲甘藍，新竹爲蘿蔔。在鳳山，於三月八日、十五日及二十日施藥，均爲粉劑，分10% DDT，1 % r BHC 及砒酸鉛與對照四處理，用藥量第一次爲每公頃十六公斤，第二次二十公斤，第三次二十四公斤（即每株甘藍撒粉第一次零點八公分，第二次一公分，第三次一點二公分），每次施藥前，調查十株甘藍上所有蛾類幼蟲種類及頭數。茲錄此三次施藥後及近收獲期（四日七日）之調查結果如表六：

表六　DDT、BHC 砒酸鉛粉劑防治甘藍蛾類幼蟲記錄（鳳山，民國四十年三、四月）

藥劑種類	調查次別	菜蛾	菜螟	斜紋夜蛾	擬尺蠖	共計	防治效力
1%rBHC	1	2	—	—	—	2	75.00
	2	—	—	—	—	—	100.00
	3	1	—	—	5	6	86.00
	4	—	13	12	—	25	84.85
	共計	3	13	12	5	33	85.14
10% DDT	1	—	2	—	—	2	75.00

	2	—	—	—	—	—	100.00
	3	—	—	—	—	—	100.00
	4	—	13	2	—	15	90.00
	共計	—	15	2	—	17	92.34
砒酸鉛	1	1	1	—	—	2	75.00
	2	—	—	—	1	1	83.33
	3	7	1	1	4	13	69.77
	4	—	143	—	1	144	14.58
	共計	8	145	1	6	160	27.93
對照	1	5	—	—	3	8	—
	2	—	—	—	6	6	—
	3	29	9	3	2	43	—
	4	—	143	22	—	165	—
	共計	34	152	25	11	222	—

據表六所示，10% DDT 防治甘藍蛾類幼蟲最佳，次爲 1% rBHC，砒酸鉛效果較差。再觀表七所示，收穫時甘藍所受蛾類幼蟲爲害程度之差異，更爲明瞭。

表七　各種藥劑處理後蛾類幼蟲爲害甘藍程度記錄

藥劑種類	健全株		輕害株		重害株		共計
	個數	%	個數	%	個數	%	個數
1% r BHC	64	78.05	18	21.95	—	—	82
10% DDT	74	92.50	3	3.75	3	3.75	80
砒酸鉛	63	76.83	6	7.32	13	15.85	82
對照	24	27.59	26	29.89	37	42.53	87

同時，蚜蟲之爲害，經用 BHC 及 DDT 者，較砒酸鉛及對照區，亦顯然減少，觀表八，即知各處理區受蚜爲害後所引起煤病發生之程度，便可知之。

表八　各種藥劑處理甘藍後蚜蟲煤病發生程度紀錄

藥劑種類	健全株		輕害株		重害株		共計
	個數	%	個數	%	個數	%	個數
1%r BHC	71	86.59	11	13.41	—	—	82
10% DDT	72	90.00	6	7.50	2	2.50	80
砒酸鉛	39	47.56	26	31.71	17	20.73	82
對照	53	60.92	24	27.59	10	11.49	87

陽明山於六月七日起，每星期施藥一次，直至八月四日爲止，共計先後施藥八次。每次於施藥後第七日，調查各處理之十株甘藍上所有各種蛾類幼蟲累計如表九：

表九　甘藍害蟲防治試驗記錄　（陽明山·民國四十年六、七、八月）

藥劑種類及倍數	擬尺蠖	斜紋夜蛾	菜蟆	菜蛾	共計	防治效力
25% DDT 乳劑×500	4	1	1	—	6	98.75
25% DDT 乳劑×1000	1	4	87	—	92	80.83
3.5% 魚籐精乳劑×500	34	6	327	7	374	22.08
3.5% 魚籐精乳劑×1000	55	2	31	18	106	77.92
(25% DDT 乳劑+3.5%魚籐精乳劑)×500	11	1	137	2	151	68.54
(25% DDT 乳劑+3.5%魚籐精乳劑)×1000	18	98	72	3	191	60.21
砒酸鉛粉	24	5	57	25	111	76.88
10% DDT 粉	5	1	130	1	137	71.46
5% DDT 粉	19	11	43	6	89	81.46
2.5% DDT 粉	37	8	252	16	313	34.79
1% r BHC 粉	32	133	2	21	188	60.83
0.5% r BHC 粉	28	4	53	—	85	82.29
對照一	124	17	136	203	480	—
對照二	84	12	526	130	754	—
共計	476	303	1854	432	3065	—
%	15.53	9.89	60.49	14.09	100.00	—

據表八各種藥劑及其倍數防治四種甘藍蛾類幼蟲之效力，並不成正比，此因將初化幼蟲，未取食及未觸及藥劑者，亦計算在內所致。如依照防治後，於收獲時所調查各處理之有商品價值之株數（表十），便可知之。卽10% DDT 粉劑，防治效力最佳，達 100%；次爲 25% DDT 乳劑五百倍，有90%防治效力；再次爲砒酸鉛，有88.24%之防治效力；1% r BHC 有85.20%；0.5% r BHC 有77.14%；5% DDT 有70.47%；對照及魚籐精一千倍，完全無效；其他各種處理，防治效力亦微。

表十　陽明山甘藍害蟲防治成效與甘藍商品價值記錄

藥劑種類及濃度	觀察株數	蟲害株數	損失%	防治效力
25% DDT 乳劑×500	50	5	100.00	90.00
25% DDT 乳劑×1000	61	40	65.51	34.43
3.5% 魚籐精乳劑×500	63	61	96.83	3.17
3.5% 魚籐精乳劑×1000	68	68	100.00	—
(25% DDT 乳劑+3.5魚籐精乳劑)×500	35	11	31.43	68.57

(25% DDT 乳劑+3.5魚籐精乳劑)×1000	35	18	51.43	48.57
砒酸鉛粉	34	4	11.76	88.24
10% DDT 粉	34	—	—	100.00
5% DDT 粉	34	8	23.53	76.47
2.5% DDT 粉	34	31	91.18	8.82
1.0% r BHC 粉	34	5	14.71	85.29
0.5% r BHC 粉	35	8	22.86	77.14
對照一	68	68	100.00	—
對照二	61	61	100.00	—

新竹供試蔬菜爲蘿蔔，主要對象爲菜心螟及僞菜蚜。本試驗所用藥劑分25% DDT 乳劑濃度二百五十倍、五百倍、一千倍與10%、5% DDT 及1%、0.5% r BHC 粉劑。試驗於十月十八日起，每星期施藥一次，至十一月二十七日止先後共計施藥六次，每次施藥後第七日調查各處理之二十株上所有菜蟲，結果各藥劑對菜心螟均有顯著之效力，足以防治；但對蚜害則不盡然，尤以5% DDT 粉劑項最無效果，而25% DDT 乳劑五百倍之防蚜效力，尙不及同劑之二百五十倍爲澈底有效。所以，今後防治該地蘿蔔害蟲，吾人以採用25% DDT 乳劑二百五十倍最適宜，以其一擧而足以防治所有蘿蔔之害蟲也。

上述三類主要菜蟲，應用藥劑防治試驗結果，以魚籐精防治僞菜蚜，BHC 防治黃條葉蚤，DDT 防治蛾類幼蟲，效力最大。且此類藥劑，本省均有大量生產，如應用適當，便可確保十字花科蔬菜之產量，與品質之提高。用藥量估計：粉劑項應用 BHC 防治黃條葉蚤，每次每公頃二十公斤，至少二次；應用 DDT 防治甘藍蛾類幼蟲，每次每公頃用量，因植株大小而有差異，在移植初期，每次每公頃十六公斤，以後每次遞增，可多至二十四公斤，液劑方面，據防治甘藍蛾類幼蟲測定結果，在定植初期，每公頃以稀釋五百倍計算爲二公升半，大株爲五公升，前後撒布六至八次。

黃條葉蚤及蛾類幼蟲用粉劑防治最好；蚜蟲以液劑，尤以乳劑最佳。在栽培十字花科蔬菜之地，用水雖不成問題，但除防治蚜蟲外，當以粉劑爲首選。價格方面，亦以粉劑爲便宜，例如10% DDT 粉劑，目下每公斤五元，每公頃施用一次，以二十四公斤計算爲一百二十元；25% DDT 乳劑每公升五十元，每公頃施用一次，以五公斤計算爲二百五十元。粉劑防治工具亦較爲便宜，甚或用最簡單之一方紗布，亦可代之。粉劑應用方便，無須換算、稀釋及携帶龐大容器等等工作之煩。

四、田間藥劑防治菜蟲與環境之關係

十字花科蔬菜種類中，甘藍、綠葉甘藍、苔菜、球莖甘藍、花菜等種類及品種，其葉有臘粉，液劑不易附着，過去菜農撒布砒酸鉛液時，常加用リノー（磺酸化油之一種）或酪素石灰以增加附着力，乳劑則可免之，粉劑則無關係，如 DDT 粉，爲防治甘藍等最理想之藥劑，因甘藍害蟲主要者爲蛾類幼蟲，DDT 對於蛾類幼蟲爲特效藥，並於用 DDT 粉後，蚜害及其誘發之煤病，亦得減輕（指甘藍而言），較應用砒酸鉛或砒酸鈣爲有利，況且蚜蟲、黃條葉蚤爲害甘藍成災之可能性，亦不如爲害蘿蔔、土白菜、結球白菜之多。

蘿蔔品種中，有葉片匍伏習性，施藥非常不易，尤以施用粉劑，僅可撒及葉面，而蚜蟲集食葉之下面，不但無法接觸藥粉，且因葉面撒布藥粉後，捕食或寄生蚜蟲之天敵，如各種瓢蟲、食蚜虻、寄生蜂等，先行觸及 DDT、BHC 等粉劑後，紛紛中毒而亡，不啻爲蚜蟲之天然防禦設備。

十字花科蔬菜爲淺根作物，並爲力求產量之增高，品質之增進，故灌水列爲主要工作。本省栽培蔬菜之灌水方法，有引水及澆水二種。引水由井中取水或由高處引水，迂迴曲折入田。引水時，水不衝及菜葉，故不論施用粉劑或液劑，藥力不會流失，非常安全。但須有引水設備。澆水則以人力擔水，將水澆入菜上，此時如菜上撒布藥粉，有被洗失之可能，尤以甘藍等葉片有蠟粉，應用粉劑，流失最易，應加注意，但如新竹香山大庄之蘿蔔，施用粉劑後，經每日上下午兩次之澆水，因葉有毛，不僅阻止藥粉之流失，反將藥粉冲入心葉間，對防治菜心螟之效力，並無影響。

栽培蔬菜，因有灌水設備工作，雖遇乾旱，而蔬菜生長，更爲良好，且施藥後，如不受雨水之流失，藥效較爲持久。例如鳳山春季防治甘藍害蟲，施藥三次，概可保障收穫，而在夏季多雨之陽明山，竹子湖一帶，防治甘藍害蟲，施藥八次，方達安全之境，故多雨之季，用藥次數應增多。

臺灣地處熱帶及亞熱帶，害蟲及十字花科蔬菜之生活及生長，並不受低溫的影響，而呈休眠現象，故不如溫帶及寒帶害蟲出現之有世代分別，及越冬現象。蔬菜栽培季節中，同時同種害蟲之各期，均可見及，連續發生不已，故在蔬菜生育期中，每隔七至十天施藥一次，最爲安全，但蚜蟲則須隨時施藥。

五、殺蟲藥劑與人之衞生問題

殺蟲藥劑對於人畜，亦有毒性，惟其致死量不同而已，即如魚藤精而言，本省亦有以食多量之魚藤根粉而自殺者，但植物質殺蟲劑之毒力，較礦物質或有機合成殺蟲劑之毒力爲低，並常遇光線潮濕或高溫而分解無效，或與鹼性輔助劑混用，如肥皂一可增加藥劑之展著，浸透等作用，二可增加游離速度，加快殺蟲作用，故如施用於蔬菜上，與人畜之衞生，可安全無慮。

礦物質殺蟲劑如砒酸鉛，砒酸鈣等，過去有明文規定，每公斤新鮮蔬果中，不得超過三點五八毫克之砒素（1945）。砒酸鉛等今因有 DDT 或 BHC 等有機殺蟲劑之代替，並此等殺蟲劑之殺蟲作用，除胃毒外，尚有觸殺、殘留、燻蒸諸作用，故目下砒素劑已不多用，況本省既不生產，而存貨又將告罄，故其對人畜之衞生，不成問題，所憂者厥爲 DDT 與 BHC 耳。

DDT 與 BHC，同出於氯之衍生物，對於人畜，亦有毒性，惟毒性不如砒等之猛烈。DDT 或 BHC 進入人畜體內之肝臟，蓄積於脂肪組織中，多則可致死亡，故目下亦有明文規定，凡 DDT 及 r BHC 每百萬份物食物上不得有五份。

應用 DDT 大部爲防治甘藍蛾類幼蟲。甘藍葉片由內生出，先生出者爲外葉，外葉匍地，或包被心葉，在育苗期及定植後初期，妥行施藥，施藥之葉片，概爲將來成熟時之外葉或包葉，此時外葉或包葉不利用爲食料，故與人之衞生無關係，因施藥時，葉片尚小，收穫時已長大至數十倍，同一單位中，藥量已改低至數十倍，並經雨露之冲洗，日光之分解，所剩無幾；充作家畜飼料，亦無關係。對於防治蘿蔔害蟲，被施藥葉片，多不爲人利用，故與人之衞生，亦無關係，至於以之作爲家畜飼料，則應考慮；而幼苗期間，欲拔苗充食，亦應注意。

BHC 大部用於防治土白菜黃條葉蚤，通常在土白菜播種發芽時及眞葉生出時撒粉二次，即可防治之。此時藥粉，多撒地上，子葉及基部數片眞葉上，此等子葉及基部數片眞葉，至土白菜收穫時因發育不大，色亦黃白，多不利用。故 BHC 可謂無附着土白菜之機會，與人之衞生亦無影響。

應用 DDT、BHC 防治蔬菜害蟲，概在初期，初期如防治得法，行之澈底，中期害蟲，發生必少，稍加防治，勢難再發，故對於應用 DDT、BHC 防治蔬菜害蟲之遺毒，實無考慮的必要。

六、結　　論

本文爲自民國三十八年以來，三年間在臺灣南北諸地，作種種十字花科蔬菜害蟲田間調查及實地防治試驗之經過紀實，所得結論如下：

1. 本省之十字花科蔬菜害蟲，常見者有十六種，各種之形態及習性，均有簡要之叙述。

2. 此十六種蔬菜害蟲中，因限於市場之需要，菜農之勞力，及土地經濟利用起見，而多行連作，前後作，結果促成爲菜蚜，黃條葉蚤及數種蛾類幼蟲之大害。

3. 爲菜蚜爲害結球白菜芥菜及蘿蔔最烈，黃條葉蚤爲害土白菜及蘿蔔最烈，蛾類幼蟲爲害甘藍最烈。

4. 爲菜蚜以六百至八百倍之3.5%魚籐精乳劑防治，效果最著；黃條葉蚤以 1% r BHC 粉劑防治最佳；蛾類幼蟲以10% DDT 粉劑最佳，蚜蟲及蛾類幼蟲如同時出現，以二百五十倍至五百倍之25% DDT 乳劑防治最佳。

5. 3.5%魚籐精乳劑，1% r BHC 粉劑，10% DDT 粉劑及25% DDT 乳劑，於蔬菜栽培後，如何用法，防治效力最大，最經濟，最安全，均有說明。

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REPORT ON THE FIELD INSECTICIDAL CONTROL OF CRUCIFEROUS INSECTS IN TAIWAN

By

C. C. Tao, L. T. Chen, and K. H. Chen.

Summary

This report was performed from 1949 to 1951. During these years, the field survey and control experiment of cruciferous insects were taken throughout of the island. The results may be summarized as below.

There are 16 species of cruciferous insects were recorded from that island, their features and habits are briefly discussed.

Among these pests, due to market necessity, utilization of labour and land, the farmers are usually continuing and overlapping to cultivate these vegetables. For this reason, to break out of turnip aphis Rhopalosiphum pseudobrassicae Davis, turnip flea beetle Phyllotreta vittata Fabricius and some species of caterpillars.

Turnip aphis attacks heavily on Brassica pekinensis, B. juncea and Raphanus sativas, turnip flea beetle on local Brassica spp. and Raphanus sativas and some caterpillars on Brassica oleracea.

Turnip aphis may be completely controlled by rotenoid emulsion (containing 3.5% crystalline retenone), its effectiveness of dilution is 600-800 times. Turnip flea beetle by 1% gamma B H C dust and the caterpillars by 10% D D T dust. If turnip aphis and caterpillars appeared at the same time, they may be controlled by the spraying of 250-500 times of 25% D D T emulsion.

After planting the plants, methods of applying these insecticides and how to gain the most effectiveness, economics and safeness were described respectively.

胡瓜露菌病之發生及防除試驗

孫守恭　簡和順

一、前　言

胡瓜露菌病 (Peronosplasmopara cubensis (B. et C.) Clint.) 普遍發生於葫蘆科植物，主要爲害胡瓜，其他越瓜、甜瓜等均有被害，臺灣各地均有發生，其爲害胡瓜至爲嚴重。露菌病自胡瓜本葉展開時卽行侵害，至結實後被害逐漸顯著。被害葉上現多角形，褐色或淡褐色之顯著病斑，葉之背面生煤烟色或暗紫色之黴。病斑發生甚多時，各斑毗鄰相隔，致葉之一部枯死，次而全葉變黃，下部諸葉遂枯死。其被害甚者，僅殘留頂端二三新葉，餘均罹病。胡瓜因發生露菌病，發育受阻，生長期縮短，收量大減，實爲栽培業者之一大威脅，故防除方法之探討，爲當今所急需之事。本文係於本分所舉行之數次小規模藥劑防除試驗，以及在臺灣南部的氣候條件下，所觀察之胡瓜露菌病發生消長的結果，藉供參考。

二、胡瓜一生露菌病罹病率調查

供試材料爲落合節成胡瓜，自民國三十五年十月五日，十月二十九日，三十六年一月十三日，三十七年九月二十二日，三十九年九月二十五日等播植五次，調查胡瓜一生之露菌病罹病率，灌水、誘引、摘芽等管理如常，計四年栽植五次，五次調查之平均結果列於下表：

第一表　胡瓜一生之露菌病罹病調查

播種後經過週數	葉數	罹病數	枯葉數	罹病率 (%)	枯葉率 (%)	備考
四星期	4.5	0.5	0	11.11	0	
五星期	8.0	1.6	0.4	20.00	5.00	
六星期	12.0	3.6	0.8	30.00	6.66	
七星期	14.0	7.7	1.9	55.00	13.57	開花結實期
八星期	17.6	10.4	4.8	59.09	27.39	
九星期	20.0	12.4	8.0	62.00	40.00	
十星期	22.0	15.0	10.0	68.18	45.45	
十一星期	23.0	16.5	11.2	71.74	48.69	採果期

由表一可知，胡瓜露菌病自本葉伸出後開始發生，至開花結實期乃漸嚴重，罹病率已達55%；到採果期爲最嚴重，罹病率高達71.74%，枯葉率爲48.69%，無病葉僅佔28.26%。

三、胡瓜露菌病週年發生調查

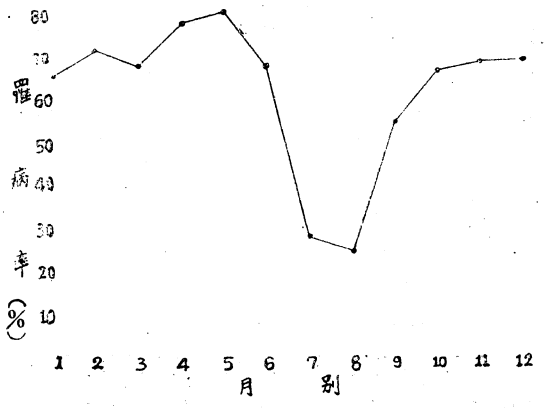
供試材料爲落合節成胡瓜，自民國卅九年四月始，每月播種一次，未開花期、開花結實期及採果期各調查一次。結果如第二表：

第二表　胡瓜露菌病週年調查

	未開花期			開花結實期			採果期		
播種月日	調查日期	罹病(%)	枯葉(%)	調查日期	罹病(%)	枯葉(%)	調查日期	罹病(%)	枯葉(%)
39年 4月17日	39年 5月23日	21.57	0	39年 6月 5日	47.56	15.07	39年 6月19日	67.67	34.82
39年 5月14日	39年 6月24日	35.09	0	39年 7月 6日	16.25	8.61	39年 7月20日	27.31	18.34
39年 6月15日	39年 7月20日	0	0	39年 8月 4日	3.00	0	39年 8月21日	24.32	7.31
39年 7月15日	39年 8月19日	3.95	0	39年 9月 6日	32.30	10.66	39年 9月19日	54.20	28.37
39年 8月15日	39年 9月20日	27.63	0	39年10月 4日	37.53	15.24	39年10月18日	65.96	38.52
39年 9月16日	39年10月18日	32.87	3.21	39年11月 1日	47.69	26.86	39年11月17日	68.19	29.56
39年10月17日	39年11月17日	29.97	0	39年12月 7日	51.59	25.51	39年12月27日	68.49	31.71
39年11月17日	39年12月27日	22.20	2.89	40年 1月13日	43.14	9.89	40年 1月30日	65.06	18.00
39年12月 3日	40年 1月20日	20.33	0	40年 2月 8日	49.82	9.58	40年 2月26日	70.92	43.63
40年 1月 2日	40年 2月20日	37.10	6.30	40年 3月 6日	52.77	17.45	40年 3月24日	67.23	20.50
40年 2月 1日	40年 3月20日	36.65	0	40年 4月 7日	54.89	26.92	40年 4月24日	77.02	42.27
40年 3月 1日	40年 4月21日	49.71	23.61	40年 5月 6日	70.67	36.20	40年 5月23日	80.25	48.63

表二所示，胡瓜露菌病全年均有發生，七、八月間發生最少，九月以後漸漸增多，至五月間發生至最高峯，罹病率達80.25%，枯葉率達48.63%。由此可知一年中六月中旬播種者，其生育期中露菌病之侵害極少，如卅九年六月十五日播種，七月二十日調查時（未開花期），未見有露菌病，八月四日調查（開花結實期），罹病率僅爲3%，八月廿一日調查時（採果期），罹病率爲24.32%，枯葉率只有7.31%。此爲一年中本病發生最輕的時期。觀圖一之消長曲線，更爲瞭然。

圖一　胡瓜採果期露菌病週年發生消長圖



四、胡瓜露菌病品種間抗病性調查

民國38年至39年，曾搜集臺灣各地胡瓜品種36種，每年種植一次，茲將採果期所調查品種間之罹病率列如下表：

第三表　胡瓜露菌病品種間抗病性調查

調查日期	38年3月	39年1月		調查日期	38年3月	39年1月	
胡瓜品種	病葉(%)	病葉(%)	平均	胡瓜品種	病葉(%)	病葉(%)	平均
立秋胡瓜	84.17	94.58	89.37	阿緣大	56.30	78.14	67.22
吊瓜子	84.32	81.67	82.99	平安節成	61.95	72.32	67.13
臺中一號	78.38	83.80	81.90	堺節成	61.94	71.77	66.85
落合二號	77.87	76.36	77.12	交新一號	63.63	68.75	66.19
日支胡瓜	73.22	79.15	76.18	三枚目節成胡瓜	59.36	72.98	66.17
白イボ胡瓜	69.48	81.57	75.52	「モ」號胡瓜	59.47	72.37	65.92
大仙節成	—	75.27	75.27	中國三尺	59.72	70.64	65.18
廣島農試	71.73	76.29	74.01	落合一號	57.47	71.80	64.63
秋胡瓜	65.27	82.06	73.66	青白節成	57.75	69.41	63.58
ナショナルビツクリング	64.45	80.17	72.31	青大胡瓜	54.54	72.58	63.56
貴般早生	69.48	70.40	69.94	早生促成	56.70	68.84	62.77
落合節成	64.71	74.85	69.78	馬込半白	55.43	69.54	62.48
相模半白節成	63.86	73.03	68.44	落合三號	53.86	69.45	61.65
加賀青長胡瓜	62.62	74.26	68.44	二宮半白	55.06	68.22	61.64
臺灣毛馬	63.18	73.12	68.15	滿洲立秋	55.98	66.20	61.09
余蔣胡瓜	67.53	68.24	67.88	印度胡瓜	67.05	54.45	60.75
仁保胡瓜	60.28	75.27	67.77	針ヶ谷	58.15	60.42	59.28
大和三尺	66.86	68.53	67.69	鳳山在來	52.29	59.97	56.13

由表三所示，各品種間對胡瓜露菌病殆無高度之抵抗性，然感病程度確有差別，最嚴重者達89.37%（立秋胡瓜），最輕者爲56.13%（鳳山本地種）。

五、胡瓜露菌病防除試驗

第一次防除試驗

材料及方法：供試材料爲落合節成胡瓜。民國卅五年十月五日，於花盆內播種，放置於庭院中，灌水、誘引、摘芽等管理如常。供試藥劑爲珪酸銅（商品名稱爲銅製劑二號）。係日製成品，設計概要如次。

處　　理	濃　　度	每週撒佈次數	每　區　株　數	共計噴藥次數
珪　酸　銅	0.25%	1	4	6
珪　酸　銅	0.25%	2	4	12
珪　酸　銅	0.25%	3	4	18
無　撒　佈	—	0	4	0

藥劑撒佈時，注意葉之裡面，並避免波及其他處理區。未開花期、開花結實期及採果期各調查一次，結果如第四表：

第四表　第一次防除試驗結果

處　理　別	調　查　日　期	總葉數	罹病數	枯葉數	罹病率	枯葉率	備　　考
硅酸銅每週一次	35. 11. 7.	9.0	2.7	0	30.0	0	未開花期
硅酸銅每週二次	〃　〃	10.7	0.7	0	6.6	0	〃
硅酸銅每週三次	〃　〃	8.8	0.3	0	3.4	0	〃
對　　照	〃　〃	9.7	4.0	0	31.2	0	〃
硅酸銅每週一次	35. 11. 21.	17.3	7.7	1.6	44.5	9.2	開花結實期
硅酸銅每週二次	〃　〃	19.5	8.3	0	42.5	0	〃
硅酸銅每週三次	〃　〃	18.0	5.0	0	27.7	0	〃
對　　照	〃　〃	17.7	10.0	3.2	56.5	18.0	〃
硅酸銅每週一次	35. 12. 11.	23.3	9.3	6.0	39.9	25.7	採　果　期
硅酸銅每週二次	〃　〃	24.2	9.3	3.5	38.4	14.4	〃
硅酸銅每週三次	〃　〃	23.0	7.3	2.2	31.7	9.6	〃
對　　照	〃　〃	1.5	14.0	8.0	65.1	37.2	〃

由上表所示，十一月廿一日（開花結實期）調查時，各區罹病率比較，無撒佈區已達56.5%，至採果期（十一月十一日），無撒佈區罹病率爲最嚴重，達65.1%，每週三次撒佈區最輕爲31.7%，其間相差33.4%，每週一次撒佈區與二次撒佈區無大差別。每週一次撒佈區與無撒佈區之差爲25.2%，由上知珪酸銅之防治略有效果。

第二次防除試驗

材料及方法：供試胡瓜仍爲落合節成種。卅五年十月廿九日花盆中播種，十一月十三日定植田間，十二月五日開始撒佈，此時胡瓜生有本葉四片。撒佈方法與前同，供試藥劑爲銅石鹼及波爾多液。設計概要如下：

處理	濃度	每週撒佈次數	每區株數	共計噴藥次數
銅石鹼液	0.15% 石鹼四倍	1	0	8
銅石鹼液	〃	2	10	16
波爾多液	0.5%	1	10	8
無撒佈	—	0	10	0

試驗結果：第二次試驗結果如下表：

第五表　第二次防除試驗結果

處理別	調查日期	總葉數	罹病數	枯葉數	罹病率	枯葉率	備考
銅石鹼液每週一次	35. 12. 19	7.5	0.4	0	5.3	0	未開花期
銅石鹼液每週二次	〃 〃	7.4	0.2	0	2.7	0	〃
石灰波爾多液每週一次	〃 〃	6.5	0.3	0	5.6	0	〃
對照	〃 〃	7.6	3.3	1.6	43.4	21.0	〃
銅石鹼液每週一次	36. 1. 10	16.3	4.6	0	28.2	0	開花結實期
銅石鹼液每週二次	〃 〃	16.4	0.6	0	3.7	0	〃
石灰波爾多液每週一次	〃 〃	14.2	2.0	0.7	14.0	5.0	〃
對照	〃 〃	16.2	9.5	4.1	58.6	25.3	〃
銅石鹼液每週一次	36. 1. 31	22.5	6.9	0.5	30.7	3.6	採果期
銅石鹼液每週二次	〃 〃	22.0	2.4	0	11.0	0	〃
石灰波爾多液每週一次	〃 〃	20.1	4.3	0.9	21.4	5.0	〃
對照	〃 〃	22.8	18.3	10.6	80.2	46.4	〃

由表五知十二月十九日調查時，未開花期無撒佈區之枯葉率已達21.0％，銅石鹼及波爾多液區尚無枯葉，自未開花至採果期胡瓜被害程度，逐漸增加，採果期每週一次撒佈區之罹病率爲30.7％，枯葉率爲3.6％，每週二次撒佈區最輕（11.0％），全無枯葉；採果期，波爾多液每週一次撒佈區之罹病率爲21.4％，枯葉率5.0％；無撒佈區之罹病率高達80.2％，枯葉率46.4％。

第三次防除試驗

第三次防除試驗，係綜合各藥劑，撒佈一定次數，比較其防治效果。供試胡瓜爲落合節成種。卅六年一月十三日播種於花盆內，一月廿七日定植田間，二月十四日開始撒佈。方法與前同，試驗設計如下：

處理	濃度	每週撒佈次數	每區株數	共計採葉次數	備考
硅酸銅	0.3%	1	40	8	銅製劑二號日製成品
王銅	0.25%	1	40	8	銅製劑一號日製成品
波爾多液	0.5%	1	40	8	等量式
銅皂液	0.2%	1	40	8	肥皂四倍
無撒佈	—	—	40	0	

試驗結果：調查結果如下表：

第六表　第三次防除試驗結果

處理別	調查日期	總葉數	罹病數	枯葉數	罹病率	枯葉率	備考
硅酸銅撒佈區	36. 2. 28	3.8	0	0	0	0	未開花期
王銅撒佈區	〃 〃	3.8	0.3	0	7.9	0	〃
石灰波爾多液撒佈區	〃 〃	3.7	0	0	0	0	〃
銅石鹼液撒佈區	〃 〃	3.9	0	0	0	0	〃
對照區	〃 〃	3.8	0	0	0	0	〃
硅酸銅撒佈區	36. 3. 21	8.7	3.4	0.5	39.1	7.0	開花結實期
王銅撒佈區	〃 〃	8.5	2.6	0.1	30.6	1.1	〃
石灰波爾多液撒佈區	〃 〃	8.5	1.3	0	15.3	0	〃
銅石鹼液撒佈區	〃 〃	8.2	1.6	0	19.6	0	〃
對照區	〃 〃	7.8	3.3	1.5	42.3	19.2	〃
硅酸銅撒佈區	36. 4. 11	16.9	11.2	2.7	66.3	16.0	採果期
王銅撒佈區	〃 〃	16.3	8.9	2.0	54.6	12.3	〃
石灰波爾多液撒佈區	〃 〃	16.8	7.2	1.3	42.9	7.7	〃
銅石鹼液撒佈區	〃 〃	16.6	7.3	0.5	44.0	3.1	〃
對照區	〃 〃	16.1	10.8	6.8	67.1	42.2	〃

上表結果，無撒佈區之罹病率及枯葉率爲最高。硅酸銅撒佈區與無撒佈區之罹病率無大差別，僅採果期枯葉率相差 26.2 %，波爾多液及銅石鹼區之罹病率最輕，波爾多液與無撒佈區罹病率之差爲24.2%，枯葉率相差 39.1%。重複證明波爾多液及銅石鹼液均有優良效果，而銅石鹼液有更好之趨向。

第四次防除試驗

由以上三次試驗，獲得下列三概念：(1)各銅製劑對於胡瓜露菌病均有若干防治效果；(2)銅石鹼及波爾多液之效果最著；(3)胡瓜對有效銅素之抗力大，未顯示有藥害現象，而對石灰之抗力弱，惟過量石灰使瓜葉硬化。

所以第四次試驗目的：(1)比較少石灰波爾多液 ($CuSO_4$:CaO= 1:1/3) 與等量波爾多液及銅石鹼液之效力；(2)比較每週撒佈一次與每兩週撒佈一次之效力。設計概要如下表，隨機排列，重複四次。

處理	濃度 (%)	撒佈日程	每區株數	共計噴藥次數	備考
等量式波爾多液	0.5	每週一次	48	7	
〃	0.5	二週一次	48	4	
少石灰波爾多液	0.5	每週一次	48	7	石灰三分之一
〃	0.5	二週一次	48	4	〃
銅石鹼液	0.16	每週一次	48	7	肥皂四倍
〃	0.16	二週一次	48	4	〃
無撒佈	—		48	0	

試驗結果：調查結果列如下表：

第七表　第四次防除試驗結果

處理別	調查日期	總葉數	罹病數	枯葉數	罹病率	枯葉率	備考
石灰波爾多液每週一次	37. 10. 18	7.7	0	0	0	0	未開花
石灰波爾多液兩週一次	〃 〃	7.0	0	0	0	0	〃
少石灰波爾多液每週一次	〃 〃	6.8	0	0	0	0	〃
少石灰波爾多液兩週一次	〃 〃	7.0	0	0	0	0	〃
銅石鹼液每週一次	〃 〃	7.2	0	0	0	0	〃
銅石鹼液兩週一次	〃 〃	7.8	0	0	0	0	〃
對照	〃 〃	4.8	0	0	0	0	〃
石灰波爾多液每週一次	37. 11. 2	17.3	5.9	0	34.1	0	開花結實期
石灰波爾多液兩週一次	〃 〃	16.6	6.5	0	39.1	0	〃
少石灰波爾多液每週一次	〃 〃	16.8	4.9	0	29.2	0	〃
少石灰波爾多液兩週一次	〃 〃	16.6	5.9	0	35.5	0	〃
銅石鹼液每週一次	〃 〃	16.7	3.4	0	20.4	0	〃
銅石鹼液兩週一次	〃 〃	16.9	5.9	0	34.9	0	〃
對照	〃 〃	14.7	7.3	0.8	49.7	5.5	〃
石灰波爾多液每週一次	37. 11. 22	29.5	18.9	2.0	64.0	6.8	採果期
石灰波爾多液兩週一次	〃 〃	29.1	18.9	8.0	64.9	27.5	〃
少石灰波爾多液每週一次	〃 〃	30.0	16.5	1.8	55.0	6.0	〃
少石灰波爾多液兩週一次	〃 〃	30.3	17.1	7.3	56.4	24.8	〃
銅石鹼液每週一次	〃 〃	29.8	16.1	0.6	54.0	2.0	〃
銅石鹼液兩週一次	〃 〃	30.5	19.4	5.4	63.6	17.7	〃
對照	〃 〃	26.6	19.2	9.9	72.2	37.2	〃

觀上表，無撒佈區之病率最高，由變量分析結果，知各處理間罹病率差異不顯著，但枯葉率方面，尤以兩週區與一週區之間爲極顯著。二週撒佈區間少石灰波爾多液與銅石鹼液相比，則以前者較好

等量波爾多液與少石灰波爾多液，勿論罹病率及枯葉率，均以後者較優。

六、結　　論

胡瓜露菌病爲臺灣胡瓜栽培之唯一障害，尤以南部各地，因胡瓜栽培期適與露菌病發生期相吻合，更增加其嚴重性。一般自本葉伸出三、四枚時，病卽發生，自開花結實期病害逐漸增加，至結果時罹病葉均達70—80%。

露菌病終年可見，七、八月發生最少，冬春二季發生最多。品種間之抗病性不顯著，在供試品種中，僅鳳山在來種及阿緣大胡瓜略具有耐病性，尤以生育前期爲然。

銅石鹼液（0.15—0.2%）及波爾多液（0.5%）均有預防之效，尤以前者爲最優。過量石灰波爾多液有碍胡瓜之生育，故以少量式爲宜。

七、摘　　要

一、本試驗目的在探求臺灣南部胡瓜露菌病之發生及其消長，供試品種爲落合胡瓜，擧行小規模之防除試驗計四次。

二、露菌病發生時期，自胡瓜本葉展開三至四枚始，開花結實後逐漸嚴重，至採果期達最高峯，罹病率達70%以上。

三、臺灣南部胡瓜露菌病週年均有發生。惟據採果期所調查之罹病葉被害率，凡六月播種被害最少，三月播種者最爲嚴重，七、八月最少，九月以後漸漸增多，至翌年五月最爲嚴重。

四、胡瓜各品種中，尙無高度抗病者，然感病程度確有差別；感病者其罹病率達89.37%，最輕者爲鳳山本地種達56.13%。

五、撒佈藥劑可抑制露菌病之爲害，但極難絕跡。

六、珪酸銅效果較遜，雖每週三次撒佈，罹病率仍達30%；王銅及波爾多液均優；銅石鹼之效果最好，每週二次撒佈者病葉僅10.9%。

七、銅石鹼撒佈區，枯葉極少。每週一次撒佈區枯葉率7%，每週二次者枯葉可絕跡。

八、少石灰波爾多液，可與銅石鹼液媲美。前者藥效維持時間較久，更爲經濟。

九、胡瓜生育迅速，應時時撒佈藥劑方有防治之效。

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THE OCCURRENCE OF THE CUCUMBER DOWNY MILDEW AND ITS CONTROL EXPERIMENTS

By

S. K. Sun H. S. Chian

Summary

1. This experiment was intended to trace out the occurrence of the cucumber downy mildew (Peronosplasmopara cubensis (B. et C.) Clint.), which is the most serious disease of cucumber, in South Taiwan. Control experiments were carried out four times in the past four years.
2. Infection begins when 3 or 4 leaves send out and becomes serious up to the fruitsetting time. The percentage of the diseased leaf is as high as 71. 74 by average of harvesting time.
3. In South Taiwan dowan downy mildew of cucumber were seen all through the year, however, it is very rare in July and August. It becomes abundant gradually from September on and reaches the highest up to May.
4. We have not found any variety resistant to mildew, however, the susceptibility among the 36 varieties tested shows siginificant different. The percentage of the diseased leaf of the most susceptible variety is 89.37, while the less susceptible variety, a Fengshan local variety, only 56.13.
5. Fungicides spray, more or less, can suppress the infection of the disease, but can not give complete control.
6. Kupoid (or Copper Fungicide No. 2) has less effect for control, the percentage of the diseased leaf is still high as 30 though sprayed 3 times weekly. Copper Fungicide No. 1 and Bordeaux mixture are much better, but Copper-soap is the best one. The percentage of the diseased leaf is about 10.9 when sprayed twice weekly.
7. Dead leaves occur slightly in Copper-soap treatment plot. The weekly sprayed plot is 7.0 per cent and none when sprayed twice weekly.
8. Bordeaux mixture (0.5%) with less lime (1/3 lime as compared with $CuSO_4$ by weight) is as good as Copper-soap (0.15-0.2%). So it is advisable to use less lime in Bordeaux mixture for the control of cucumber downy mildew. And it is more economic because its fungicidal effect would maintain a longer time.
9. As cucumber grows quickly, all the fungicides, which act as protectants, should be sprayed frequantly if it is hoped to raise cucumber successfully.

Fengshan Tropical Horticulture Experimental Station,
Fengshan, Kaohsiung, Taiwan.
une 30, 1951.

ANNUAL AND LOCAL VARIATION OF THE VARIETAL RESISTANCE OF RICE TO THE BLAST DISEASE

A Criticism to the Stability of Varietal Resistance based upon the Field Experiments in Taiwan

YOSHIO HASHIOKA*

Stability of the varietal resistance to the disease in rice is an important problem for breeding and spreading of the resistant varieties, since in certain varieties or cases the inherent varietal resistance is influenced greatly not only by the environmental conditions but also by the appearance of the new pathogenic races of the parasite. As has been pointed out by the author (1950,a)based upon the studies on the mechanism of prevalence of the rice blast disease, the inherent resistance of rice is of great importance for preventing the prevalency of the diseases, especially that in the tropics where the parasite survive almost all the year round. Nevertheless, the experimental foundations on the stability of the varietal resistance, especially those extending over the different climatic localities, are too little to criticize this problem.

"The experiments on the variation of blast injury in the rice varieties" which were conducted simultaneously at the seven different localities in Taiwan during the five consecutive years from 1934 to 1938 offered us a good material for criticising such a problem. This series of experiments was intended with the aim of clarifying the annual and local variation of varietal resistance of rice to the blast disease, and carried out under the direction of T. MIYAKE, the former chief of the Phytopathological Department of Agricultural Research Institute of Taiwan, with good cooperations of the staffs in seven agricultural experiment stations which are scattered at the different climatic localities in Taiwan. However, it is a great pity for the agronomists that the resultant data of the experiments have been left unadjusted and not published up to the present. The present author, who took charge a part of this series of experiments, has carried out many calculations based upon a vast number of the experimental data gained in all the stations where the present experiments were undertaken, and read justed as such a short paper as reported here. Although one and a half decades has passed from that time when the experiments were undertaken, the data still offer us many informations and are useful for

* Formerly pathologist in Taiwan Agricultural Research Institute,and now in National Hokuriku Agricultural Experiment Station, Japan.

the pathologists and agronomists who are engaging in breeding and extention of the disease resistant rice and in research as well as control of the rice disease.

MATERIALS AND METHODS

The experiments are consisted of two series. The lst series was continued for three consecutive years from 1934 to 1938, and the 2nd was for two years of 1937 and 1938. These two series of experiments were different in the varieties employed and some of the methods of observations.

(1) Varieties employed

Eight varieties were emp'oyed in each series of experiments, among which two, *i, e.*, Taichung No. 65 and Kameno-o, were used throughout these two series as the control varieties. The remaining six, each of them was the representative supreme varieties at the time of those experiments, were used for the test varieties. They are as follows:

Control varieties-Taichung No. 65 (P), Kameno-o(J)

Test varieties- The lst series of experiment (1934-1936) Mitsui(J), Asahi(J), Aikoku(J), Tainun No. 18(P)*, Taichung Sp. No. 6(P), Chia I woan No. 2(P)**.

The 2nd series of experiment (1937-1938) Tainun No. 22(P), Taipei No.6(P)Hsin Chu Aikoku No. 1 (P), Tainun No. 114(P). N. 103(P)*** Kao Hsiun No. 10 (P)

(2) The places where the experiments were performed.

Provincial Agricultural Research Institute at Taipei and six prefectural agricultural experiment stations at Taipei, Hsin Chu, Taichung, Tainang, Kao Hsiung and Hwalien.

(3) Experimental plots-Every plot was duplicated, and the area used for 1 plot was 0.1 or 0.2 are according to the field conditions of the stations.

(4) Manuring-As shown by the following table, twice amount as much as the standard of N, P_2O_5 and K_2O was given with ammonium sulphate, calcium perphosphate and potassium sulphate, respectively, with an exception at Taichung where triple amount was supplied (kg. per ha.).

Elements given	**** TAIPEI	***** Taipei	Hsin Chu	Taichung	Tainang	Kao Hsiung	Hwalien
N	18.8	15.6	22.6	34.5	20.2	24.0	22.7
P_2O_5	15.0	16.0	17.7	32.7	19.7	14.0	14.5
K_2O	7.5	18.0	12.0	20.6	18.8	14.0	15.8

(J) and (P) represent the Japanese endemic varieties and 'Peruglai' varieties, respectively 'Peruglai' is the general terminology given to the varieties which were bred in Taiwan.

*'Tainun' means Provincial Agricultural Research Institute.

**'Woan' means serotinous or late.

***This was bred in Tainan Prefectural Agricultural Experiment Station.

****Provincial Agricultural Research Institute ***** Prefectural Agricultural Experiment Station of Taipei. The same abbreviations will be applied correspondingly to the following all tables.

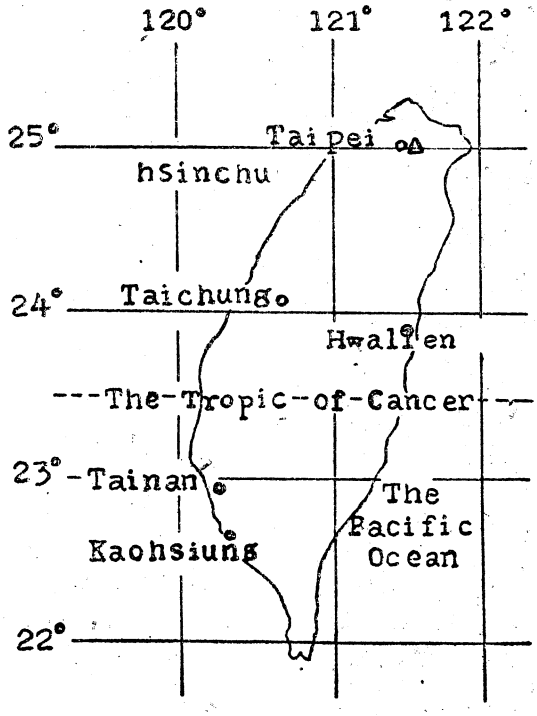


Fig. 1. A map showing the localities where the experiments were undertaken.

▲ Provincial Agricultural Research Institute

O Prefectural Agricultural Experiment Station

(5) Dates of sowing and transplanting. The dates of sowing and transplanting at each stations were somewhat different according to the weather conditions of the respective years, but such differences were in the extent shown in the following table.

Operation	TAIPEI	Taipei	Hsin Chu	Taichung	Tainang	Kao Hsing	Hwalien
Sowing	Big. Feb.	Big. Feb.	Big. Feb.	End. Jan.	End. Jan.	End. Den.	Big. Feb.
Transpl.	Mid. Mar.	Big. Mar.	Big. Mar.	End. Feb.	Mid. Eeb.	End. Jan.	Big. Mar.

(6) Density of transplanting (Number of hills per 0.1 a.).

TAIPEI	Taipei	Hsinchu	Taichung	Tainang	Kaohsiung	Hwalien
180	245	180	200	180	180	160

(7) Observations and examinations

Parts of pl. examin.	Observations	Growth stage examined
Leaves	P. L. (Percentage of infected leaves)* N. L. (Number of lesions per 1 leaf)* G. I. (Grade of infection estimatd by the scale)**	Culmination of tillering and the end of heading. respectively

Ears	P. E. (Percentage of infected ears)	Ten days after heading and mature stage
Nodes of culms	P. N. (Percentage of infected nodes)	Mature stage

*The observation was limitted to the 1st series of experiments.

**The observation was limitted to the 2nd series of experiments. The grade of infection was estimated by means of five scale, *i. e.*, none, slight, moderate, heavy and severe. which were prepared by the specimens of the affected plants.

RESULTS OF EXPERIMENTS

A. THE FIRST SERIES OF EXPERIMENTS IN 1934, 1935 AND 1936.

(a) Annual Variation of the Varietal Resistance

The annual variation of infection on the different parts of the rice plants are shown below in the average valus of infection at the seven different stations.

Table 1. Annual variations of the average value of the grade of infection at seven localities.

Observ. *	Year**	Kam.	Aik.	Mit.	Ash.	Tn. 18	Tc. S. 6	Tc. S. 65	Cl. 2
P. L. (Culm. of tillering)	1934	49.5	38.0	44.5	39.2	33.1	43.1	39.5	32.1
	1935	54.7	57.6	56.5	56.9	42.9	51.9	37.0	44.1
	1936	46.3	36.7	45.7	51.7	35.8	42.5	37.2	36.5
	Aver.	50.2	44.1	48.9	49.3	37.3	45.8	37.9	37.6
N. L. (Culm. of tillering)	1934	4.6	2.6	3.0	2.8	2.6	3.3	2.6	2.8
	1935	7.3	5.2	5.8	4.3	4.6	4.6	5.5	4.2
	1936	4.6	4.1	5.4	4.8	2.6	3.4	3.3	2.3
	Aver.	5.5	4.0	4.7	4.0	3.5	3.8	3.8	3.1
P. L. (End of heading)	1934	65.6	62.5	73.0	71.6	66.9	79.0	62.4	57.2
	1935	79.3	77.1	76.7	78.8	75.8	78.6	64.5	71.2
	1936	68.7	44.6	56.8	61.5	51.8	57.7	51.1	51.3
	Aver.	71.2	61.4	68.8	70.6	64.8	71.8	59.3	57.7
N. L. (End of heading)	1934	16.7	7.8	8.8	9.3	5.5	8.9	5.4	5.5
	1935	7.7	8.5	6.4	7.2	7.2	5.9	4.8	5.7
	1936	4.7	3.3	3.7	3.6	3.9	4.9	3.4	3.7
	Aver.	9.7	6.5	6.3	6.7	5.5	6.6	4.5	5.0
P. E. (Mature stage)	1934	46.5	49.6	38.7	43.8	26.0	49.0	18.3	27.5
	1935	67.4	62.9	44.2	55.6	32.0	49.3	27.0	36.3
	1936	49.4	41.9	35.8	35.1	22.4	38.4	19.8	26.3
	Aver.	54.4	51.5	39.5	44.9	26.8	45.6	21.7	30.0
P. N. (Mature stage)	1934	28.6	15.4	8.7	10.4	8.7	10.1	10.1	9.4
	1935	17.0	11.2	18.4	5.9	4.0	7.2	4.4	5.4
	1936	23.5	5.6	3.4	4.9	4.2	5.2	3.5	5.5
	Aver.	23.0	10.7	10.2	7.1	5.8	7.5	6.0	6.7

*The abbreviations 'P. L. '. 'N. L. ', etc. represent the observations stated in the experimental procedure (7).

**The abbreviations of variety name are as follows: Kam. Kameno-o, Aik. Aikoku, Mit.-Mitsui. Ash.-Asahi; Tn-.18-Tainun No.18, Tc. S.6- Taichung Sp. No.6, Tc. 65-Taichung No. 65,Cl 2-Chia 1 Woam No. 2. The same will be applied to the following all tables.

As shown in the above table, the disease was most prevalent in 1935, less in 1934 and least in 1936. The epidemic of the disease of leaves as well as ears (panicles) in 1935,

seemed to be due to the warm and moist weather, especially to cloudiness and rainfall at the biggining of March in the southern Taiwan, the early half of April in the middle, and the end of April in the northern, respectively, during which periods the disease of leavs was very prevalent. Notwithstanding such an annual variation of prevalence, the order of the grade of infection among the different varieties seems to be rather constant *inter se*. When these varieties are arranged according to the order number which represents the most resistant as 1 and the most susceptible as 8, the order of the resistance recorded by the different observations on the different parts of plants at the different growth stages will be tabulated as follows:

Table 2. Annual variations of the order of resistance determined by the average value of the grade of infection (Table 1) at seven localities.

Year	Observ.	Kam.	Aik*	Mit.	Ash.	Tn. 18	Tc. S. 6	TC.65	Cl.2
1934	P. L. (C. t.)*	8	3	7	4	2	6	5	1
	N. L. (C. t.)	8	1	6	4	1	7	1	4
	P. L. (E. h.)	4	3	7	6	5	8	2	1
	N. L. (E. h.)	8	4	5	7	2	6	1	2
	P. E. (M. s.)	6	8	4	5	2	7	1	3
	P. N. (M. s.)	8	7	1	6	1	4	4	3
	Aver.	8	4	5	6	1	7	2	2
1935	P. L. (C. t.)	5	8	6	7	2	4	1	3
	N. L. (C. t.)	8	5	7	2	3	3	6	1
	P. L. (E. h.)	8	5	4	7	3	6	1	2
	N. L. (E. h.)	7	8	4	5	5	3	1	2
	P. E. (M. s.)	8	7	4	6	2	5	1	3
	P. N. (M. s.)	7	6	8	4	1	5	2	3
	Aver.	8	7	6	5	3	4	1	2
1936	P. L. (C. t.)	7	3	6	8	1	5	4	2
	N. L. (C. t.)	6	5	8	7	2	4	3	1
	P. L. (E. h.)	8	1	5	7	4	6	2	3
	N. L. (E. h.)	7	1	4	3	6	8	2	4
	P. E. (M. s.)	8	7	5	4	2	6	1	3
	P. N. (M. s.)	8	7	1	4	3	5	2	6
	Aver	8	4	5	7	2	6	1	3

*As for the abbreviations, see experiment procedure (7).

From the average of the orders of resistance of different plant parts at different growth stages shown in the above table, the number of years which correspond to each average order in every variety is counted as the following table. (For instance, 'Aikoku' shows the 4th order in average resistance in two years, *i. e.*, 1934 and 1936, and the 7th in one year, 1935, accordingly this variety occupies the columns 4 and 7 with the numerals of 2 and 1, respectively.)

Table 3. Number of years corresponds to the average order of resistance.

Varieties	Order of resistance							
	1	2	3	4	5	6	7	8
Kameno-o								3
Aikoku				2			1	
Mitsui					2	1		
Asahi					1	1	1	
Tainan No. 18	1	1	1					
Taichung Sp. No. 6				1		1	1	
Taichung No. 65	2	1						
Chiai woan No. 2		2	1					

As shown in the above table, the annual variations of the varietal resistance are comparatively constant in spite of the difference of localities, and those eight varieties employed in this series of experiments are divided into the following three groups according to the order of resistance.

(1) The resistant group (The varieties which fluctuate from the 1st order to the 3rd in resistance)-Taichung No. 65, Tainun No. 18, Chia I woan No. 2,

(2) The intermediase group (The varieties which fluctuate from the 4th to the 5th) Mitsui, Aikoku, Asahi, Taichung Sp. No. 6.

(3) The susceptible group (The variety usually takes the last order) Kameno-o.

The annual variation of resistance is smallest in the resistant group, especially in Taichung No. 65 and Tainun No. 18.

(*b*) *Local Variation of the Varietal Resistance*

The three-years-average of the natural infection of the different varieties at the different localities is shown in the next table.

Table 4. Three-years-average of natural infection on the different parts of plants at the seven different localities

Locality	Observ.	Kam.	Aik.	Mit.	Ash.	Tn. 18	Tc.S. 6	Tc.65.	Cl. 2
TAIPEI	P. L. (C. t.)	22.4	21.1	33.6	34.9	20.1	32.2	21.6	20.1
	N. L. (C. t.)	1.9	2.0	2.1	1.9	2.1	2.3	2.0	1.9
	P. L. (E. h.)	62.9	42.9	49.4	56.1	35.6	54.7	41.7	44.3
	N. L. (E. h.)	3.0	4.2	2.2	2.6	1.9	3.1	2.1	3.1
	P. E. (M. s.)	15.2	19.7	7.3	5.6	4.4	13.2	3.6	5.0
	P. N. (M. s.)	14.1	3.7	0.8	2.3	1.0	2.4	1.5	0.9
Taipei	P. L. (C. t.)	69.1	54.0	63.9	63.0	48.9	59.6	64.3	43.5
	N. L. (C. t.)	7.1	4.0	7.0	7.2	3.1	4.3	8.0	2.5
	P. L. (E. h.)	89.3	87.6	90.0	92.6	79.1	88.5	91.3	87.9
	N. L. (E. h.)	10.9	13.1	10.6	9.7	8.8	6.3	7.8	9.0
	P. E. (M. s.)	88.0	87.9	48.2	58.3	19.7	67.4	32.4	22.0
	P. N. (M. s.)	49.0	21.9	8.2	0.7	9.8	14.7	13.1	8.3

Hsin chu	P. L. (C. t.)	72.4	41.1	57.8	56.0	49.3	57.9	43.9	53.3
	N. L. (C. t.)	6.1	3.1	5.1	4.6	3.9	5.0	3.9	4.9
	P. L. (E. h.)	77.1	55.7	69.4	72.1	64.9	70.1	54.3	73.1
	N. L. (E. h.)	4.4	3.3	3.6	3.8	2.6	3.5	2.3	2.6
	P. E. (M. s)	70.5	60.6	47.7	50.5	24.1	44.8	39.9	45.6
	P. N. (M. s.)	22.7	15.6	7.1	9.3	6.9	8.4	6.5	8.2
Taichung	P. L. (C. t.)	67.7	70.3	66.6	67.2	52.4	60.2	36.9	53.9
	N. L. (C. t.)	13.1	8.7	7.2	7.5	6.2	6.4	6.2	7.5
	P. L. (E. h.)	85.0	81.0	91.8	96.1	93.9	90.8	83.3	91.5
	N. L. (E. h.)	12.3	10.5	11.9	11.7	9.1	11.1	5.7	8.1
	P. E. (M. s.)	88.7	86.0	60.0	82.9	54.4	79.3	28.2	69.9
	P. N. (M. s.)	22.5	14.1	6.7	6.5	5.9	7.9	3.6	7.7
Tainang	P. L. (C .t.)	43.3	47.0	27.5	39.2	36.1	40.2	36.1	29.8
	N. L. (C. t.)	4.8	5.2	6.0	4.2	2.4	3.8	2.7	1.9
	P. L. (E. h.)	40.6	42.1	48.6	48.0	29.0	52.4	24.7	25.0
	N. L. (E. h.)	3.1	2.4	2.5	2.4	1.5	2.8	1.3	1.2
	P. E. (M. s.)	20.6	35.0	13.3	17.2	4.3	18.2	5.5	6.7
	P. N. (M. s.)	23.6	7.3	36.4	6.5	4.4	3.8	5.0	7.1
Kao hsiuu	P. L. (C. t.)	63.7	65.6	65.4	73.3	54.9	65.8	51.8	64.2
	N.L. (C. t.)	4.3	3.7	3.5	4.0	4.2	3.9	2.8	3.1
	P. L. (E. h.)	91.9	94.1	89.3	93.3	99.6	91.5	97.5	92.9
	N. L. (E. h.)	16.4	10.7	11.9	14.8	11.3	15.9	11.3	11.3
	P. E. (M. s.)	23.6	7.3	36.4	6.5	4.4	3.8	5.0	7.1
	P. N. (M. s.)	20.5	4.3	4.2	5.3	4.0	3.8	3.8	6.0
Hwalien	P. L. (C. t.)	12.8	13.0	18.1	10.5	8.1	4.9	4.7	5.3
	N. L. (C. t.)	1.1	1.0	1.1	0.9	1.0	0.8	1.0	0.8
	P. L. (E. h.)	33.3	35.6	43.4	34.9	30.7	34.4	24.4	12.7
	N. L. (E. h.)	1.6	2.0	1.5	1.5	1.4	1.3	1.3	1.2
	P. E. (M. s.)	3.6	8.1	5.9	8.6	3.5	6.2	14.9	3.6
	P. N. (M. s.)	8.5	8.3	8.5	8.1	5.8	8.9	8.4	8.3

Likewise the case of annual variation mentioned in the foregoing section, the numerals of the above-named datum are also represented by the order of varietal resistance (but the tables is abbreviated), and further the aveage of these order of resistance of each variety as each locality is calculated as the following table.

Table 5. Local variation of the average of the order of resistance of all the plant-parts of the different varieties

Locality	Kam.	Aik.	Mit.	Ash.	Tn. 18	Tc. S. 6	Tc. 65	Cl. 2
TAIPEI	7	6	4	5	1	8	3	2
Taipei	8	5	4	7	1	3	6	2
Hsin Chu	8	3	6	7	2	5	1	4
Taichung	8	6	5	7	2	4	1	3
Tainang	8	7	6	4	3	5	1	2
Kao Hsiun	7	3	3	8	5	6	1	2
Hwalien	6	7	8	5	2	3	4	1
Average	8	6	5	7	1	4	3	1

From the above table, number of localities correspond to the average order of resistance in each variety is tabulated as follows:

Table 6. Comparison of number of localities correspond to the average order of resistance of all the plant-parts in each variety

Variety	Order of resistance							
	1	2	3	4	5	6	7	8
Kameno-o						1	2	4
Aikoku			2		1	2	2	
Mitsui			1	2	1	2		1
Asahi				2	1		3	1
Tainang No. 18	2	3	1		1			
Taichung Sp. No. 6			2	1	2	1		1
Taichung No. 65	4		1	1		1		
Chia I waon No. 2	1	4	1	1				

As shown in the above table, the local variation of varietal resistance is considerably wider in comparison to the annual variation, though the employed varieties are roughly groupsed also into the following three categories.

(1) The resistant group (The varieties which fluctuate from the 1st order to the 4th in resistance) Tainun No. 18, Taichung No. 65, Chia I woan No. 2.

(2) The intermediate group (The varieties which fluctuate from the 3rd to the 8th.) Aikoku, Taichung Sp. No. 6, Mitsui, Asahi.

(3) The susceptible group (The variety which fluctuate from the 6th to the 8th.) Kameno-o.

In view of the results stated above, the variation of varietal resistance in the different years is smaller then that at the different localities, and the range of variations under different environmental conditions is smaller in the resistant varieties than in the susceptible ones.

B. THE SECOND SERIES OF EXPERIMENTS IN 1937 AND 1938.

(*a*) *Annual Variation of the Varietal Resistance*

The results of Observations of infection on the different plantparts of the varieties in each year are shown in an average of the records at the seven localities.

Table 7. Annual variations of the average value of the grade of infection at the seven localities

Observ.*	Year	Kam.**	Tn. 22	Tp. 6	H. A. 1	Tc. 65	Tc. 114	N 103	KH.10
G. I. (Culm. of tillering)	1937	2.9	3.3	1.7	1.9	2.3	1.0	1.7	1.1
	1938	1.9	1.7	1.4	1.0	1.4	0.4	1.1	1.2
	Aver.	2.4	2.4	1.5	1.4	1.9	0.7	1.4	1.1
G. I. (End of heading)	1937	3.0	2.8	1.5	1.7	1.7	0.8	1.8	1.2
	1938	2.0	2.1	1.4	1.1	1.6	0.8	1.9	1.6
	Aver.	2.3	2.3	1.4	1.3	1.5	0.7	1.7	1.3
P. E. (Ten days after heading)	1937	42.3	18.9	16.3	31.2	22.1	8.7	15.8	6.5
	1938	17.3	12.8	13.5	27.4	7.9	5.2	11 6	4.2
	Aver.	29.8	15.9	14.9	22.0	15.0	6.3	12.6	5.4

P. E. (Mature stage)	1937	65.2	60.1	43.4	54.7	26.5	27.9	37.4	20.6
	1938	49.0	38.2	41.5	45.7	27.2	26.7	39.8	29.7
	Aver.	57.1	49.2	42.5	47.7	26.8	26.8	38.6	24.9
P. N. (Mature stage)	1937	23.3	5.7	21.9	31.9	8.5	6.6	6.3	9.2
	1938	35.9	6.3	22.8	39.2	7.9	7.1	5.6	4.9
	Aver.	28.0	6.0	22.4	34.7	8.2	6.9	5.9	7.7

*G. I. means the grade of infection of leaves which was represented by the index number determined by presumption with the naked eye, i. e. no or a little-0, slight-1, moderate-2, heavy-3, severe-4.

**Abbreviations of the variety name. Tn. 22, -Tainun No. 22. Tn. 6-Taipei No. 6, H. A. 1-Hsinchu-Aikoku No. 1, Tc. 114-Taichung No. 114, K. H. 10-Kaohsiung NO. 10.

As shown in the above table, the disease was more prevalent in 1937 than in 1938 due to the susceptibility of rice plants predisposed by coolness during the middle of March and intense propagation of the blast fungus induced by rapid ascending of temperature during the middle of April, and in the northern Taiwan the ear blast was also prevalent due to the rainy weather during the early half of June.

Likewise the foregoing experiments, the annual variation of the order of varietal resistance will be tabulated as follows:

Table 8. Annual variations of the order of resistance determined by the average value of the grade of infection at the seven localities

Year	Kam.	Tn.22.	Tp. 6	H. A. 1	Tc. 65	Tc 114	N. 103	K. H. 10
1937	8	8	4	6	5	2	3	1
1938	8	5	5	7	3	1	4	2
Aver	8	7	5	6	4	1	3	2

From the above table, number of years corresponds to the average order of resistance in each variety will be induced as the following table.

Table 9. Number of years corresponds to the average order of resistance in the different varieties

Varieties	Order of resistance							
	1	2	3	4	5	6	7	8
Kaneno-o								2
Tainun No. 22			1		1	1		
Taipei No. 6				1	1			
Hsin Chu Aikoku No. 1						1	1	
Taichung No. 65			1		1			
Taichung No. 114	1	1						
N. 103			1	1				
Kao Hsiun No. 10	1	1						

As shown in the above table, the employed eight varieties can be divided into the following 4 classes according to the order of resistance.

(1) The resistant group (The varieties which fluctuate from the 1st order to the 3rd.)-Taichung No. 114, Kao Hsiun No. 10.

(2) The moderately resistant group (The varieties fluctuate from the 3rd to the 5th.)-N. 103, Taichung No. 65, Taipei No. 6.

(3) The moderately susceptible group (The varieties fluctuate from the 5th to the 7th.)-Tainun No. 22, Hsin Chu Aikoku No. 1.

(4) The susceptible group (The variety unsually takes the last order) Kameno-o.

(b) Local Variation of the Varietal Resistance

The two-years-average of the natural infection of the different plant-parts at the different localities is as undermentioned.

Table 10. Two-years-average of the natural infection on the different parts of plants at the seven different localities

Locality	Observ.*	Kam.	Tn.22	Tp. 6	H. A. 1	Tc. 65	Tc. 114	N. 103	K.H.10
TAIPEI	G. I. (C. t.)	2.0	2.0	1.5	1.5	2.0	0.5	1.5	1.5
	G. I. (E. h.)	1.5	2.0	1.0	1.5	1.5	1.0	2.0	1.5
	P. E. (A. h.)	0.0	0.0	0.1	0.2	0.9	0.0	0.0	0.0
	P. E. (M. s.)	51.7	31.8	19.3	29.0	8.4	4.2	12.4	10.5
	P. N. (M. s.)	24.4	3.5	31.0	48.5	6.4	6.1	3.6	5.5
Taipei	G. I. (C. t.)	2.5	2.5	1.5	2.0	2.5	1.0	1.5	1.0
	G. I. (E. h.)	2.5	2.0	1.0	1.5	1.5	1.0	1.5	1.0
	P. E. (A. h.)	52.7	17.8	17.6	46.8	20.2	6.4	7.6	3.2
	P.E. (M. s.)	91.0	92.2	65.9	76.7	37.7	46.4	59.3	31.8
	P. N. (M. s.)	52.8	4.2	46.1	57.9	13.4	10.3	4.7	8.5
Hsin Chu	G. I. (C. t.)	3.5	2.5	2.5	1.5	2.0	1.5	1.5	1.0
	G. I. (E. h.)	4.0	4.0	3.0	2.0	2.0	1.0	4.0	1.5
	P. E. (A. h.)	20.6	20.4	29.4	33.3	33.1	13.8	25.1	6.7
	P. E. (M. s.)	45.0	53.0	71.1	80.5	40.1	50.7	67.4	42.2
	P. N. (M. s.)	2.9	3.9	3.2	4.2	2.2	3.9	1.5	1.9
Taichung	G. I. (C. t.)	2.0	2.0	1.0	1.0	2.0	0.5	1.0	1.0
	G. I. (E. h.)	2.0	2.0	0.5	0.5	1.5	0.0	0.5	0.5
	P. E. (A. h.)	41.4	35.3	14.8	25.0	10.0	6.9	21.4	7.8
	P. E. (M. s.)	48.5	32.6	21.7	28.6	14.7	7.9	22.0	8.4
	P. N. (M. s.)	49.2	11.8	28.8	45.8	16.8	7.3	14.7	6.8
Tainang	G. I. (C. t.)	3.0	3.5	1.5	1.0	2.0	0.5	1.0	1.0
	G. I. (E. h.)	3.0	2.5	1.0	1.0	0.5	0.0	1.0	1.0
	P. E. (A. h.)	22.4	3.3	13.5	21.0	5.8	1.7	8.1	3.8
	P. E. (M. s.)	47.6	34.0	24.7	23.1	14.0	16.0	25.3	11.7
	P. E. (M. s.)	32.8	7.2	23.9	60.9	8.5	10.4	4.4	12.5
Kao Hsiun	G. I. (C. t.)	1.5	3.0	2.0	1.5	2.0	1.0	3.0	1.5
	G. I. (E. h.)	2.0	4.0	3.0	1.0	4.0	2.0	4.0	4.0
	P. E. (A. h.)	32.0	34.2	22.9	23.8	19.5	15.6	25.6	12.8
	P. E. (M. s.)	84.0	86.7	77.0	68.3	69.1	57.3	76.9	58.9
	P. N. (M. s.)	23.7	6.4	12.2	16.7	7.0	6.1	8.2	6.1
Hwalien	G. I. (C. t.)	2.0	2.0	0.5	1.5	0.5	0.5	0.5	1.0
	G. I. (E. h.)	2.0	1.5	1.5	2.0	1.5	1.0	1.0	1.5
	P. E. (A. h.)	7.8	0.2	0.2	4.2	1.1	0.0	0.3	0.2
	P. E. (M. s.)	22.0	13.9	17.8	27.5	3.0	5.2	7.1	11.1
	P. N. (M. s.)	11.4	5.3	11.7	9.2	3.4	4.2	4.5	12.5

*The abbreviation 'G. I.' and 'A. h.' mean 'grade of infection' and '10 days after heading', respectively.

When the variation of varietal resistance to leaf-blast infection tabulated above, *i. e.*, the data of the column of G. I. (Grade of infection), is compared by the number of

localities corresponds to each grade of infection at the different growth-stages, the data will be rearranged as follows:

Table 11. Number of localities corresponds to the grade of infection of leaves represented by the index number

Grade of infect.	Kam.		Tn. 22		Tp. 6		H. A. 1		Tc. 65		Tc. 114		N. 103		K. H. 10.	
	C. t.	A. h.	C. t.	A. h.	C. t.	A. h.	C. t.	A. h.	C. t.	A. h.	C. t.	A. h.	C. t.	A. h.	C. t.	A. h.
0												2		1		1
0.5					1	1		1	1	1	4		1	2		2
1.0					1	3	2	2			3	4	2	1	5	1
1.5	1	1		1	3	1	4	2		4			3	1	2	2
2.0	3	3	3	3	1		1	2	5	1		1				
2.5	1	1	2	1	1				1							
3.0	1	1	1			1										
3.5	1		1													
4.0		1		2												

From the above table, the employed varieties can be divided into the following 4 classes according to the resistance of leaves.

(1) The resistant group (The grade of infection usually lies o-1.0)-Taichung No. 114.

(2) The moderately resistant group (The grade of infection lies 0-1.5) Kao Hsiun No. 10, N 103.

(3) The moderately susceptible group (The grade of infection usually lies 0.5-2.5) Hsin Chu Aikoku No. 1, Taipei No. 6, Taichung No. 65.

(4) The susceptible group (The grade of infection lies 1.0-4.0)Kameno-o, Tainung No. 22.

In the next place, the local variation of the average order of resistance as regard the ear-blast and node-blast will be tabulated in an average of 2 years.

Table 12. Local variation of theaverage order of resistance of ears and nodes of culms

Locality	Kam.	Tn. 22	Tp. 6	H. A. 1	Tc. 65	Tc. 114	N. 103	K. H. 10
TAIPEI	8	4	6	7	4	1	2	2
Taipei	8	5	6	7	4	2	2	1
Hsin Chu	1	6	7	8	5	3	3	2
Taichung	8	6	4	7	3	1	4	2
Tainang	8	4	6	7	3	1	5	2
Kao Hsiun	8	7	5	4	3	1	5	1
Hwalien	8	4	6	7	2	1	3	5
Aver.	8	5	6	7	3	1	4	2

Inducing from the above table, number of localities corresponds to the average order of resistance of the ears as well as nodes of culms of each variety can be tabulated as follows:

Table 13. Comparison of number of localities corresponds to the average order of resistance of ears and nodes of culms

Variety	Order of resistance							
	1	2	3	4	5	6	7	8
Kameno-o	1							6
Tainang No. 22				3	1	2	1	
Taipei No. 6				1	1	4	1	
Hsin Chu Aikoku No.1					1		5	1
Taichuug No. 65		1	3	3				
Taichuug No. 114	5	1	1					
N 103		2	2	1	2			
Kao Hsiun No. 10	2	4			1			

From the above table, the employed eight varieties are divided into the following 4 groups according to their resistance of ears as well as nodes of culms.

(1) The resistant group (The varieties fluctuate from the 1st order to the 5th.)-Taichung No. 114, Kao Hsiun No. 10.

(2) The moderately resistant group (The varieties fluctuate from the 2nd to the 5th)-N 103, Taichung No. 65.

(3) The moderately susceptible group (The varieties fluctuate from the 4th to the 8th.)-Taipei No. 6, Tainung No. 22, Hsin Chu Aikoku No. 1.

(4) The susceptible group (The variety usually takes the last)-Kameno-o.

Judging from the above-mentioned grouping based upon the order of resistance of leaves, ears and nodes of culms, the employed varieties can be divided into the following four groups each of which being consisted with the varieties completely same as in the annual variation,

(1) The resistant group Taichung No. 114, Kaohsiun No. 10.

(2) The moderately resistant group N 103, Taichung No. 65, Taipei No. 6.

(3) The moderately susceptible group Hsin Chu Aikoku No. 1, Tainang No. 22.

(4) The susceptible group-Kameno-o.

DISCUSSION AND CONCLUSION

The present experiments on the variaties of variatal resistance were repeated in five different years at the seven different stations which are scattered in the different climatic regions in Taiwan extending from 25°02′ N (Taipei) to 22°37′ N (Kao Hsiun), though among which two, *i. e.*, Provincial Agricultural Research Institute and Taipei Prefectural Agricultural Expriment Station situate closely one another. Moreover, the cultural conditions of the experimental plots, *e. g.*, manuring density of transplanting, season of sowing and transplanting, *etc.*, were considerably different according to the difference of stations.

Further the varietal resistance was compared by the mutual average order of resistance calculated from the grade of infection at the different growth stages on the different parts of plants examined, *i. e.*, leaves, ears and nodes of culms. Even under such different experimental conditions, it is an important fact that the variation of varietal resistance was restricted to a rather limitted extent when considered as a whole. For example, in the first series of experiments which were continued three consecutive years, the annual variations of varietal resistance in the resistant varieties extended over three orders from the 1st to the 3rd in resistance, those of the intermediate group ranged from the 4th to the 7th, and the susceptible alway stook the last, the 8th. Also in the local variation at the seven different places, similar three groups consisted of the varieties completely same as in the annual variation could be distinguished, though the range of order of resistance of the respective variety was somewhat different from the annual variation. In the second series which was conducted in the two consecutive years, four groups could be divided also according to the grades of infection in both of the data calculated from the annual average and those from the local average, and moreover, the varieties which are included in each group were also same in both, except only one, Taipei No. 6 which was included in the last order of the class of moderately resistant in the annual variation, and in the first of the class of moderately suscenptible in the local variation. As a whole, the variation of order of resistance was somewhat larger when calculated by the local average than when by the annual average. It is not clear whether or not this is due to the fact that the local difference of climatic conditions at the different localites was larger than the annual difference at the same locality.

In the next place, Taichung No. 65, the resistaut control variety, was included in the resistant group and occupied the 1st rank of that group in the 1st series of experiments, while it was included in the group of moderately resistant and occupied the 2nd position in the second series. This is due to the difference of resistance of the varieties employed in these two series of experiments. Namely, the varieties employed in the second series of experiments are considerably resistant in comparison to those used in the 1st series due to the advancement of breeding on the disease resistance. On the other hand, Kameno-o, the susceptible control variety, was always ranked to the last order (most susceptible) throughout both series. It goes without saying, however, even such variety as Kameno-o, the data of the individual cases of observation on the different plant parts at the different growth stages, were not always completely parallel, but it ranked to the most susceptible order when the data under all the environments were avaeraged. Considering the results stated above, the varietal resistance of rice to the blast disease is considerably stable, so far as the present two series of experiments were concerned.

Nevertheless, the term 'stable' used in the present paper is merely a comparative one, and, as a matter of fact, it was rendered as 'considerably stable' when considered as a whole in such experiments of large as scale the present field trials. Accordingly, in such experiments conducted under the limitted experimental conditions as those made by the previous workers which will be mentioned later, or even in certain cases of the limitted extent of the present experiments, it may naturally be considered that there are

considerable variations of varietal resistance, In order to discuss this matter more decidedly. some considerations on the causes of variations of varietal resistance will be briefly stated below. though the following phenomens are more or less correlated *inter se*, and are not distinguished clearly each other.

In the farmers' paddy field, impurity of seeds, for example, mixing of different varieties or lines which resemble closely each other in the morphological characters often induce the adverse order of apparent varietal infection. On the other hand, conscious or unconscious artificial selection of the resistant lines among the definite variety will also result the phenomenon which is mistaken as the natural variation, induced by the environmental conditons. Further, under certain environmental conditions, especially when the plants are raised in the places quite different from the native localities in the weather conditions, natural segregation may offen induced and still in the limitted cases even natural hybridization may occnr. In the present experiments, however, the seeds used in these different stations were distributed from the Agricultural Research Institute after approval on the heritable uniformity. Therefore, the variation of the varietal infection occurred in those different stations can be considered not to be due the ununiformity of the seeds employed.

The reactions of rice to the natural-and artificial environments which induce susceptibility, *e.g.*, coolness, excess of nitrogen supply, *etc.*, are different according to the physiological characters of the respective variety, accordingly undgr such conditions the resistance or susceptibity of certain varieties is often extremely effected, and that of others is almost uneffected. Moreover, the growth habits of the respective variety induced by the response to temperature condition, length of daytime, *etc.*, also cause the variation of infection, since the susceptibility or resistance of rice plants to the blast infection is different according to the growth stage (age) of them (HASHIOKA, 1950,a), especially the necks of panicles are most susceptible at the time of heading, but become resistant with the lapse of days after heading. In this connection, IKATA *et al*, (1931) pointed out that many of the varieties in the northern Japan become susceptible to the neck-blast when they are introduced to the southern Japan. According to the presumption of the present author, this fact seems to be due to the promotion of heading in the northern varieties induced by the short day in Okayama (Southern Japan) where their experiment was conducted, or to the other response of them to the environmental factors different from those of Hokkaido and Tohoku districts, the native place of the northern varieties. YASUDA (1942) also reported an example in the middle of Japan that the order of neck-blast infection among several varieties employed was reversible when they were cultured either in the mountains or in the plains. This seems also due either to the short day or to the dewy and cooler condition of the mountains favourable for the blast prevalency. According to BOKURA (1934), the fact that the neck-blast resistance of certain varieties except highly resistant ones is somewhat variable when grown in different localities, is due to the difference of time of heading during which the plants are blasted, if temperature is favourable for the fungus. In this case, the rainy and warmer condition favourable for the infection for only a few days during heading effects greatly for the varietal infection,

accordingly the order of varietal infection may be easily reversible according to the weather conditions during such a short period. Such phenomena as mentioned above may be regarded either as the so-called disease escaping due to the difference in growth duration of each variety of as those due to the physiological change of resistance effected by the environmental conditions.

There is one more important cause of variation of varietal resistance concerned the part of the parasite. As early as 1922-23, SASAKI reported from Shikoku, Japan, that the heavy infection of the rice blast disease noticed on five plants out of 766 F_2 individuals which were derived from the crossing between Tsurugi No. 160 (resistant) and Benkei No. 116 (resistant) might be due to a race (race B) of *Piricularia oryzae* more virulent than the race (race A) against which the parental resistance was tested, since both parents were proved to be completely resistant to race A. This is the first report which paid attention to the variability of the varietal resistance to the blast disease. Since that time, there have been some advanced steps on the problem of variation of the varietal resistance. TOCHINAI *et al.* (1932), HEMMI *et al.* (1934; 1941) made studies on the physiologic specialization of the rice blast fungus, but they did not develop to the variation of varietal resistance occurring in nature, although they made also some laboratory experiments on the difference of pathogenicity of the strains of the fungus. More recently, in Japan, the problem of races of the blast fungus has become to be reconsidered according to the world advancement of such studies. In this connection, SUZUKI (1951) found recently eight different races of the blast classified accosding to the mode of germinatios of conidia as well as appsessoria formation, and made some laboratory inoculation experiments with certain differential varieties. These studies mentioned above made an advancement of the problem of the variation of varietal resisnce induced by the heritable characters of the blast fungns, but under the present status of study no experi-mental result has been reported on the appearance of the different races of the fungus which are fully influential for govering the variariation of natural infection and prevalency.

In Louisiana, RYKER (1947, 1948) reported that the resistance of the rice varieties to the leaf spot, *Cercospora oryzae*, was broken by the appearance of the new pathogenic races of the fungus, and the natural prevalency due to such new race occurred in the paddy field where those past resistant varieties were raised. In. the rice blast disease, however, such a distinct phenomenon has not yet been known experimentally up to the present, though some empirical obserations have seldom been reported. Also in the present experiments which are largest in scale among the field trials on the blast disease ever reported up to the present, presence of the races of the fungus distinctly different in pathogenticity had not been found.

The grade of resistance of varieties employed in the present studies, especially those used in the 1st series of experiments, was very low in comparison to that of the varieties distributed at present. Recently the blast resistance of the rice verieties widely distributed in Japan as will as Taiwan has been elevated greatly due to the advancement of breeding, especially the introduction of the resistant genes of the tropic varieties to the Japnanse varieties. As has been proved experimentalily by the present author (1950, b, c), in general,

high resistance of the 'indica' type varieties to the blast, especially the leaf-blast, is hardly effcted by the environmental conditions in spite of the fact that the susceptibility of the 'Japonica' type varieties is considerably influenced by the environmental factors, such as coolness, nitrogen manuring, *etc.* The varietal blast resistance of rice, therefore, is becoming more stable year by year.

中　文　摘　要

季節與區域對於稻熱病抗病性之變異

熱帶環境下所栽培之稻作品種，必須具有堅定之抗病性，方能抑制稻熱病之蔓延，但此種抗病性，是否因季節及稻作栽培區域不同，而影響其穩定情形；斯乃育種及推廣上，極關重要之問題，此亦本試驗所欲探討之目的。

根據五年來（二十三年～二十七年）在臺灣不同氣候區，包括25°02′N（臺北）至22°37′N（高雄）分別在七個場所，獲得之試驗結果，每年按稻作不同生育時期，對於葉、節及穗頸稻熱病之抗病程度，逐一加以分析其結果，在不同區域中，品種間抗病性之强弱，雖略有差異，惟大體言之，其差異之程度並不太大，但在不同季節及栽培情形之下，抗稻熱病之特性，恒有一定不變，惟種子之純度，植株之自然變異，品種之生理反應，以及病原菌之生理小種等現象，多少能够誘致抗病性發生變異，應加考慮。

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Vol. 3, No. 3 September. 1952

AGRICULTURAL RESEARCH

CONTENTS

The Relation of Total Egg Weight to Hatching Power……T. Y. Lee…… 1

A Study of Tannin in the Pericarp of Longan……C. H. Loh…… 7

Report on the Field Insecticidal Control of Cruciferous Insects in Taiwan……C. C. Tao, L. T. Chen & K. H. Chen……15

The Occurrence of the Cucumber Downy Mildew and Its Control Experiments……S. K. Sun & H. S. Chian……31

Annual and Local Variation of the Varietal Resistance of Rice to the Blast Disease……YOSHIO HASHIOKA……39

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