

SHORT COMMUNICATION

**LARVA SURVIVAL PENETRATING THE SCLEROTIC LAYER INSIDE THE COCOA POD**

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**ABSTRACT** - *Cocoa Pod Borer (CPB), Conopomorpha cramerella (Snellen) (Lepidoptera: Gracillariidae)* is the most damaging pest of cocoa in Malaysia and other growing areas in the South East Asia region and in Papua New Guinea. Infestations by this pest, if left uncontrolled, may result in total yield loss or causing severe economic loss. Host plant resistance is one of the useful components in Integrated Pest Management (IPM) of this pest. In some of the cocoa clones may have smooth pod surface and hard sclerotic layer (SCL). There is a report mention that no evidence of resistance to CPB due to smooth pod surface. There is a report on larval mortality is higher with cocoa clone with hard SCL. This study was carried out to determine the percentage of larval survival from egg stage up to adult stage penetrating the SCL of the cocoa pod. This study was carried in the natural field condition by using the fresh cocoa pod which hanging up at the cocoa pod. The objective of this study is to evaluate the percentage of larval survival from egg stage up to adult stage penetrating the SCL of the cocoa pod. The study was conducted at Cocoa Research Station Quoin Hill in year 1993. Green matured cocoa pod under natural field condition were cage randomly with gravid female CPB for an eggs. Cocoa pod were checked daily for CPB egg and marked as a cycle using a soft needle. Cocoa pod contain CPB egg were protect from egg laying with other CPB, from rainfall using a plastic sheet and using a wire mesh cage to protect from infected from the mammalian pest. The CPB eggs were examined daily for egg hatchability. Every five (5) day interval, the cocoa pods were dissected stage by stage using disruptive method to examined the larva survival inside the cocoa pod. The places or sites and portions of the cocoa pod where the larvae penetrated were examined by peeling the epicarp of the cocoa pod husk. Every inches of the cocoa pod as draw in diagram in Plate 2 was examined for the existence of CPB larva. The number and the stage survival of larva inside the cocoa pod were recorded. The same process in year 1993 was repeated with new female of CPB in year 2017. The same procedure of study was carried out once again at Cocoa Research and Development Centre, Tawau, Sabah. Result from this study showed that when the larva spent 10 day time inside the cocoa pod, nearly 2 (two) % of the larva capable to emerged as an adult. Result from this study also showed that when the larva spent up to 30 days inside the cocoa pod, only 16 % of the larva capable to emerge to an adult stage. Result from this study also showed that in range of nearly 2 (two) % up to 16.0 % of the larva which hatched from the CPB egg were capable to penetrate inside the cocoa pod and tunnel out from the cocoa pod through in and out from SCL layer of the cocoa pod and became an adult.

**Key words:** Cocoa pod borer, larva, survival, sclerotic layer, cocoa pod husk, sclerotic layer

**INTRODUCTION**

Cocoa Pod Borer (CPB), *Conopomorpha cramerella* (Snellen) (Lepidoptera: Gracillariidae) is the most damaging pest of cocoa in Malaysia and other growing areas in the South East Asia region and in Papua New Guinea. This major pest of cocoa can cause considerable yield loss. Infestations by this pest, if left uncontrolled, may result in total yield loss or causing severe economic loss (Azhar, 1990). Yield loss above 60% infestation losses will increase rapidly (Day, 1983). Pod infested with CPB will produce lighter beans (Lim and Phua, 1986) and a lower grade of cocoa (Wurth, 1909) but did not affected flavour, fat content of the nib, shell content of the bean and percentage of defective beans in dry bean sample (Day,1985).

Chemical control using insecticide has been widely used to manage the pest. However, cultural practises, such as sleeving the pods are also

popular among the smallholders. Biological control by egg parasitoid is also promising but not widely used by the smallholders. There is a limitation on this control method due to high establishment cost and other technical technique. Host plant resistance is one of the useful components in Integrated Pest Management (IPM). In some of the cocoa clones may have smooth pod surface and hard sclerotic layer (SCL). Azhar and Lim (1987) reported that no evidence of resistance to CPB due to smooth pod surface. Day, 1985 reported in his study that the larval mortality is higher with cocoa clone with hard SCL.

This study was carried out to determine the percentage of larval survival from egg stage up to adult stage penetrating the SCL of the cocoa pod. This study was carried in the natural field condition by using the fresh cocoa pod which hanging up at the cocoa pod.

## MATERIALS AND METHODS

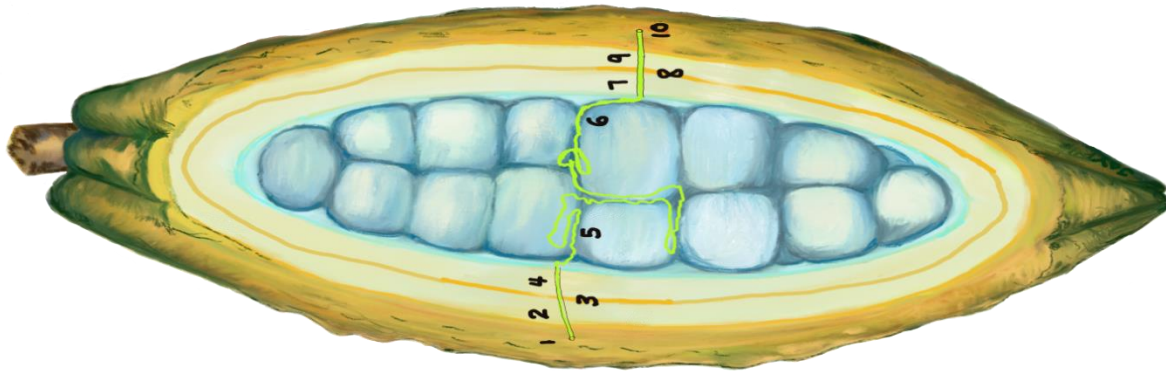
The study was conducted at Cocoa Research Station Quoin Hill in year 1993. CRDC Tawau. Green matured cocoa pod under natural field condition were cage randomly with gravid female CPB for an eggs. Cocoa pod were checked daily for CPB egg and marked as a cycle using a soft needle. Cocoa pod contain CPB egg were protect from egg laying with other CPB, from rainfall using a plastic sheet and using a wire mesh cage to protect from infected from the mammalian pest. The CPB eggs were examined daily for egg hatchability. Every five (5) day

interval, the cocoa pods were dissected stage by stage using disruptive method to examined the larva survival inside the cocoa pod. The places or sites and portions of the cocoa pod where the larvae penetrated were examined by peeling the epicarp of the cocoa pod husk. Every inches of the cocoa pod as draw in diagram in Plate 2 was examined for the existence of CPB larva. The number and the stage survival of larva inside the cocoa pod were recorded. The same process in year 1993 was repeated with new female CPB and in year 2017 the same procedure of study was carried out once again.

Plate 1: Larva survival study



Plate 2: Diagram of the cocoa pod with the SCL



Note:

Larval tunnel inside the cocoa pod	Larva tunnel outside the cocoa pod
1 – Cocoa pod husk	5 & 6 - Cocoa mucilage and cocoa bean
2 – Pre – sclerotic layer	7 – Pre – sclerotic layer
3 – Sclerotic layer	8 – Sclerotic layer
4 – Post sclerotic layer	9 – Post sclerotic layer
5 & 6 - Cocoa mucilage and cocoa bean	10 - Cocoa pod husk

## RESULTS AND DISCUSSIONS

Result from this study showed that when the larva spent 10 day time inside the cocoa pod, nearly 2 (two) % of the larva capable to emerged as an adult. Result from this study also showed that when the larva spent up to 30 days inside the cocoa pod, only 16 % of the larva capable to emerged to an adult stage. Result from this study also showed that in range of nearly 2 (two) % up to 16.0 % of the larva which hatched from the CPB egg were capable to penetrate inside the cocoa pod and tunnel out from the cocoa pod through in and out from SCL layer of the cocoa pod and became an adult.

Result from this study showed that the number of larva survive inside the cocoa pod is higher in year 2017. Study in year 1993 showed that there is no larva survive inside the cocoa pod up to 30 days. Study in year 2017 showed that more than 70 % of the larvae survive inside the cocoa pod up to day 30. Infact, number of larva survive up to day 10 are also increase. This study showed that the larva build up the capability to survive inside the cocoa pod longer than study in year 1993.

Table 1: Percentage of larva CPB survived inside the cocoa pod under natural condition

Period of larva caged (day)	No. of egg	No. of egg hatched	Larvae tunnel inside the cocoa pod					Larvae tunnel outside the cocoa pod					CPB larva survived (%)	
			SF	PSL	SL	PO SL	MU	MU	PSL	SL	PO SL	SF		
1	829	638	213	366	56	2	2	0	0	0	0	0	0	0
5	938	681	174	154	138	34	124	0	0	0	0	0	0	0
10	567	408	48	68	80	23	189	33	6	1	0	11	1.9	
15	663	471	71	106	39	14	232	13	18	16	4	78	11.8	
20	733	442	82	74	31	10	248	12	5	3	8	71	9.7	
25	537	298	32	45	15	2	152	15	4	4	6	60	11.2	
30	570	411	47	114	34	9	219	1	1	0	0	91	16.0	

Note:

Larval tunnel inside the cocoa pod	Larval tunnel outside the cocoa pod
SF – Cocoa pod husk	MU – Mucilage or cocoa bean
PSL – Pre-sclerotic layer	PSL- Pre sclerotic layer
SL – Sclerotic layer	SL – Sclerotic layer
POSL – Post sclerotic layer	POSL – Post sclerotic layer
MU – Mucilage or cocoa bean	SF – Cocoa pod husk

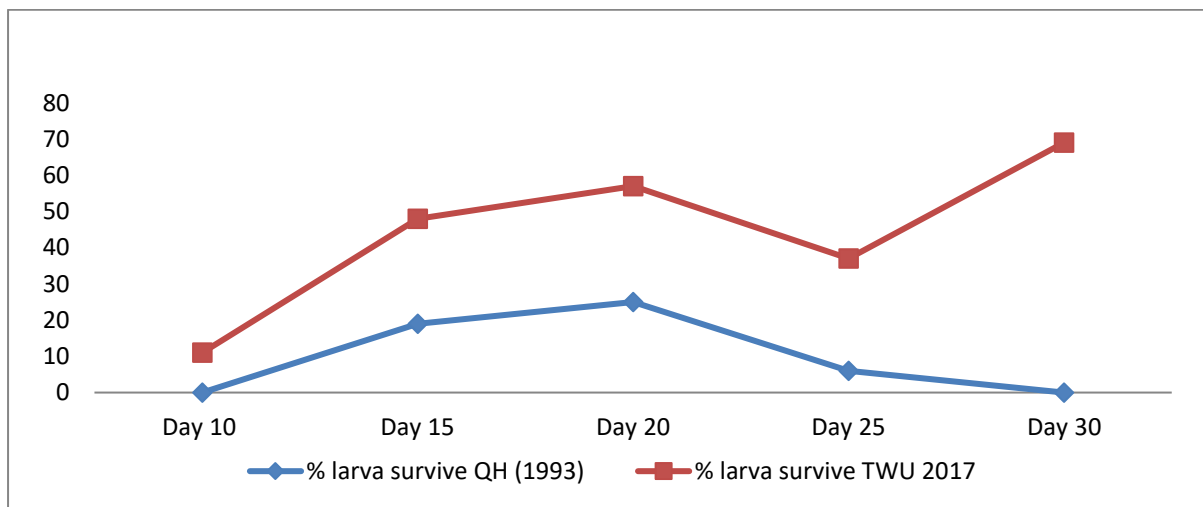


Figure 1: Larva of CPB survived by period inside the cocoa pod under natural condition.

## CONCLUSIONS

This study indicated that the larva of CPB are capable to penetrate the hardest part of the cocoa pod and survive inside the pod to chew and used the mucilage as a food source to grow up. After survive inside the cocoa pod range from 10 up to 30 days,

the larva once again capable to tunnel out the hardest part of the cocoa pod to penetrate out and became an adult. This study are also indicated that the larva capable to chew the hardest part of the cocoa pod twice to became and adult.

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