BUNCHES WITH DIFFERENT FRUIT SET

Good
Fruit set = 71.69%

Moderate
Fruit set = 31.13%

Poor
Fruit Set < 10%

POLLINATING INSECTS OF OIL PALM IN AFRICA

Coleoptera

1. ***Elaeidobius kamerunicus***
2. ***E. subvittatus***
3. ***E. plagiatus***
4. ***E. singularis***
5. ***E. bilineatus***
6. ***Prosoestus sculptilis***
7. ***P. minor***
8. ***Microporum congolense***
9. ***M. dispar***
10. *Carpophilus nitidus*
11. *Atheta burgeoni*

Diptera

1. Muscidae
2. Ceratopogonidae
3. Syphidae
4. Dolichopodidae

Hymenoptera

1. Apoidae
   Apis mellifica
2. Encyrtidae
3. Diapriidae

Desmier de Chenon (1981). IRHO. La Me Station, Ivory Coast

APPEARANCE OF OIL PALM POLLINATING WEEVIL

E. kamerunicus

E. plagiatus

E. subvittatus

E. bilineatus

E. singularis

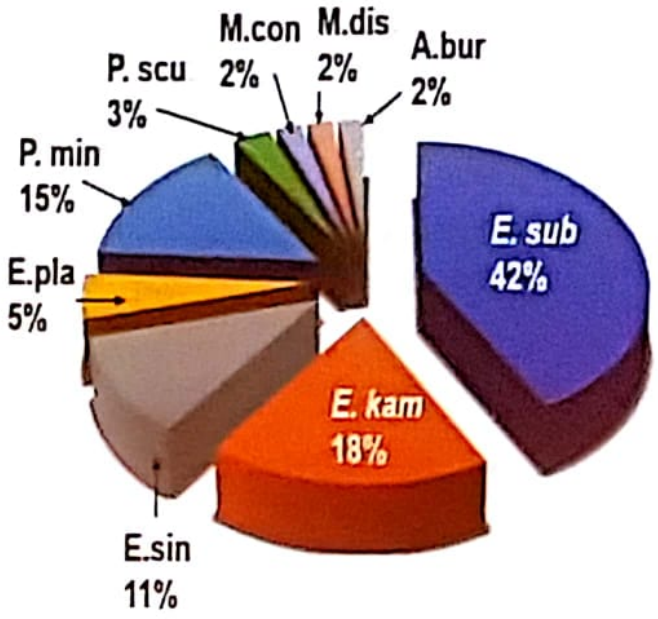
P. minor

P. sculptilis

M. congolense

M. dispar

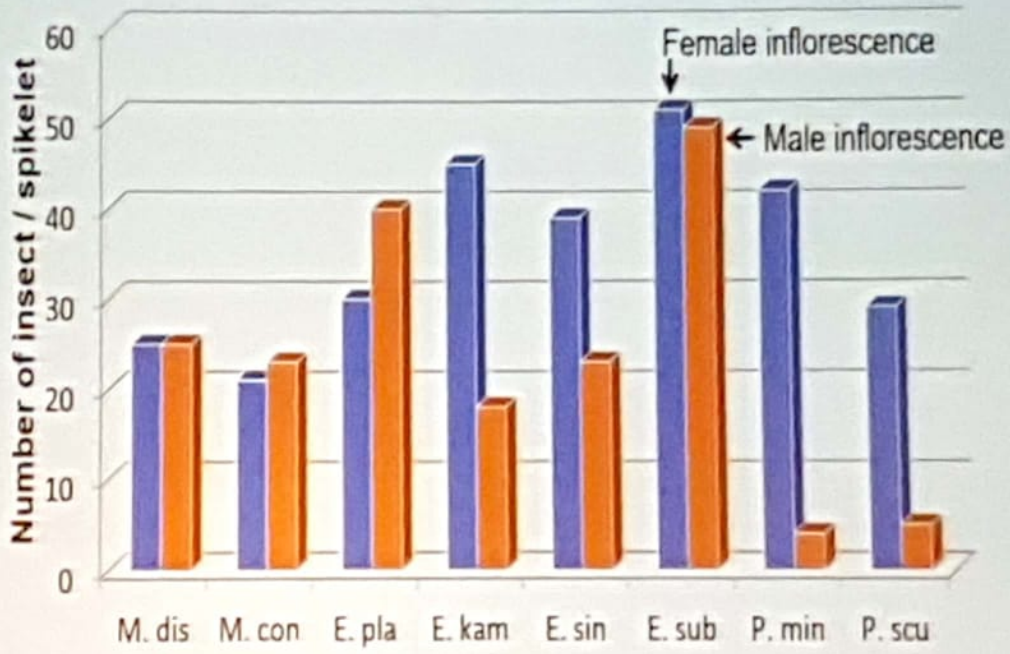
COMPOSITION OF POLLINATING WEEVIL ON ANTHESISING INFLORESCENCES



1. E. subvitatus
2. E. kamerunicus
3. E. singularis
4. E. plagiatus
5. P. minor
6. P. sculptilis
7. M. congolensis
8. M. dispar
9. A. burgeoni

Hala *et al.*, (2012). La Me Experimental Station, Ivory Coast.

POPULATION OF OIL PALM POLLINATING WEEVIL ON MALE AND FEMALE INFLORESCENCE



Kouakou Herve K et al., (2013). Influence of the growing area on oil palm inflorescence insect population. *Journal of Research in Biology* 3(4): 940-946

ADVANTAGEOUS TRAITS OF POLLINATING WEEVIL *Elaeidobius kamerunicus*

Research by R A Syed in Cameroon in 1977

1. Short life cycle & high reproductive rate
2. Abundance of species on male inflorescence: E.k > E.s > E.p
3. Abundance of species in dry season: E.k > E.s > E.p
4. Abundance of species in wet season: E.k > E.s = E.p
5. Abundance of species on all ages of palm: E.k > E. p > E. s
6. Searching ability : E.s > E.k > E.p
7. Pollen carrying capacity: E.k (150p/a) >E.p & E.s (15p/d)
8. Host-specificity : E.k restricted to only oil palm

Female

E. subvittatus *E. plagiatus* *E. kamerunicus*

Syed in RA (1979)

INTRODUCTION OF POLLINATING WEEVIL

To improve FFB yield and reduced labour cost of intensive assisted pollination

In July 1980, a batch of 1044 pupae of *E. kamerunicus* arrived from London to Kuala Lumpur. Intensive Quarantine (*Syed 1982, Kang & Zam, 1982*)

Introduction of *E. kamerunicus*

- Feb 1981. Mamor Estate, Kluang, Johor (Morning).
- March 1981. Pamol Estate, Sandakan, Sabah (Afternoon).
- Feb 1982. released in most estates in Malaysia

- June 1981. Papua New Guinea
- Dec 1981. Thailand
- Mac 1983. Indonesia

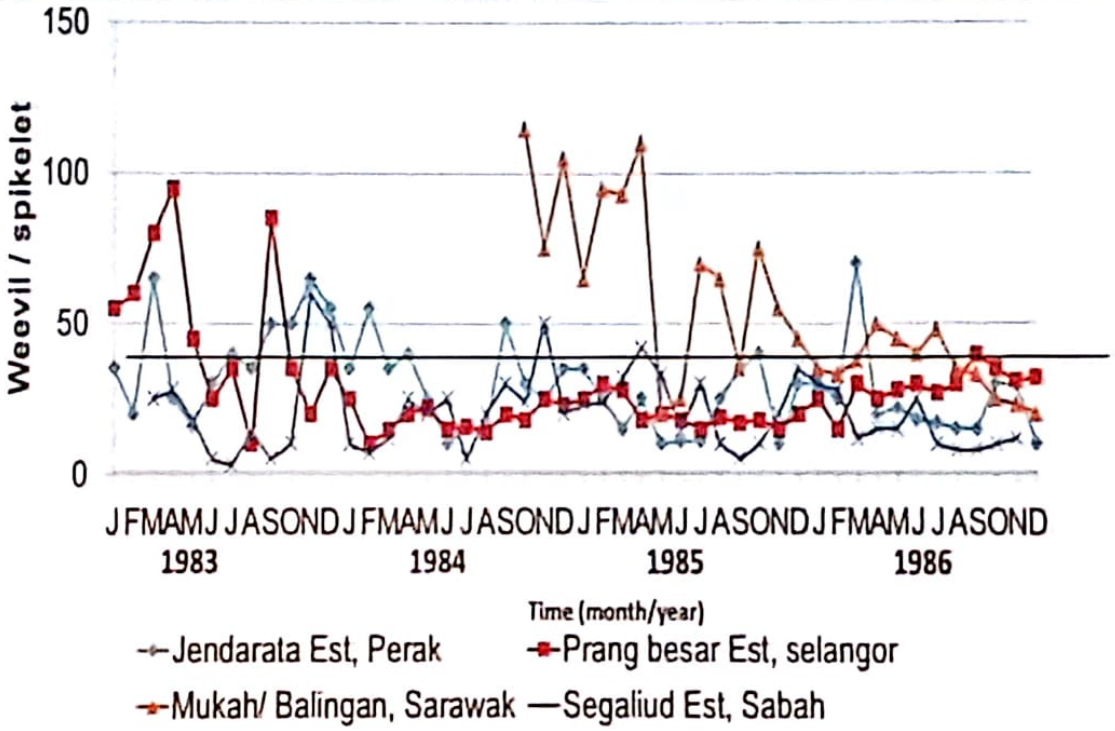
Law & Syed (1984)

EFFECT OF POLLINATING WEEVIL ON BUNCH COMPONENTS

No	BUNCH COMPONENT	PAMOL ESTATE		MAMOR ESTATE	
		Before (Mac-Jun 1981)	After (Dis81-Mac82)	Before (Mac-Jun 1981)	After (Dis81-Mac82)
1	Bunch weight (kg)	23.5	26.9	10.7	13.6
2	Fruit set (%)	53.4	71.2	47.8	76.0
3	Fruit/Bunch (%)	60.4	64.4	60.4	68.3
4	Mesocarp/Fruit (%)	74.8	70.6	76.5	74.8
5	Oil/Bunch (%)	22.0	21.5	22.7	24.9
6	Kernel/Fruit (%)	9.1	11.5	7.8	10.2
7	Shell/Bunch (%)	7.1	8.0	15.7	15.0
8	Kernel/Bunch (%)	5.5	7.4	4.7	7.0
9	Fruit weight (g)	11.2	7.7	13.1	8.9

Syed (1994)

POPULATION OF POLLINATING WEEVIL FROM 1983 TO 1989



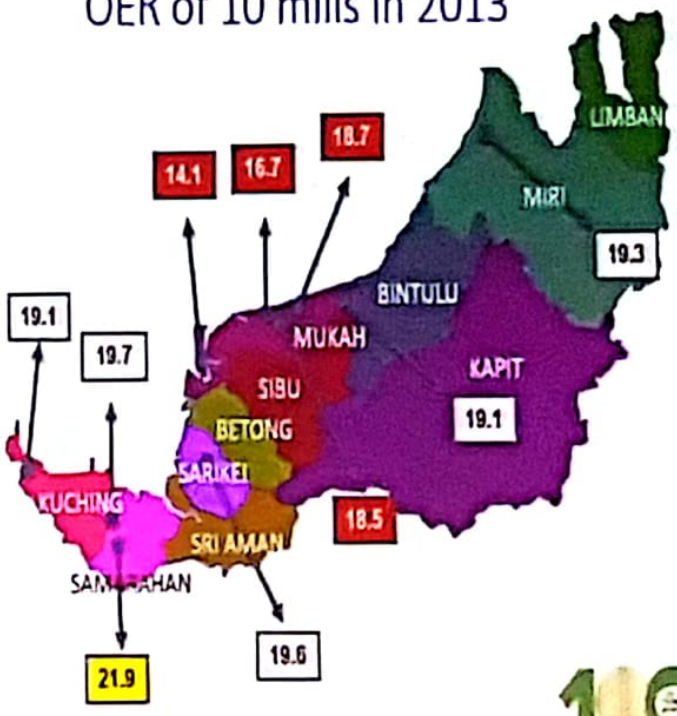
Basri et al., (1987)

REOCCURRENCE OF POOR POLLINATION

1. Since 1980 and 1990 in Sabah.
2. In 1993 in Sabah, poor fruit set expected due to climate, high rainfall.
3. In 1998 in Sabah, most plantation affected by poor fruit set.
4. In 2013, low OER in coastal mills in Sarawak, due to poor pollination?.
5. In 2016, a national survey, more than 57,500 ha affected by poor pollination.

MPOB (2016)

OER of 10 mills in 2013

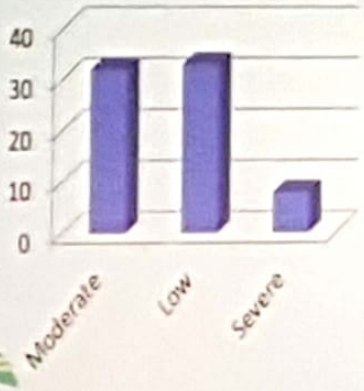


From Kushairi *et al.*, (2014)

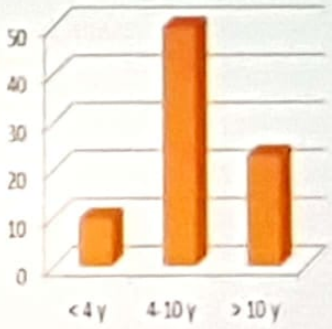
POOR FRUIT SET FORMATION IN MALAYSIA 2016

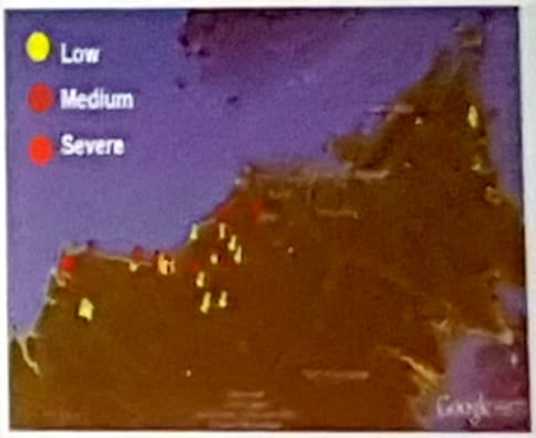
	Yes	No	Total
Number (N)	69	50	119
Percentage (%)	58.0	42.0	100
Affected areas (Ha)	57,519.6	375,874.5	443,394.1

Estate with Level of Fruit Set (%)



Palm Age With Poor Fruit Set



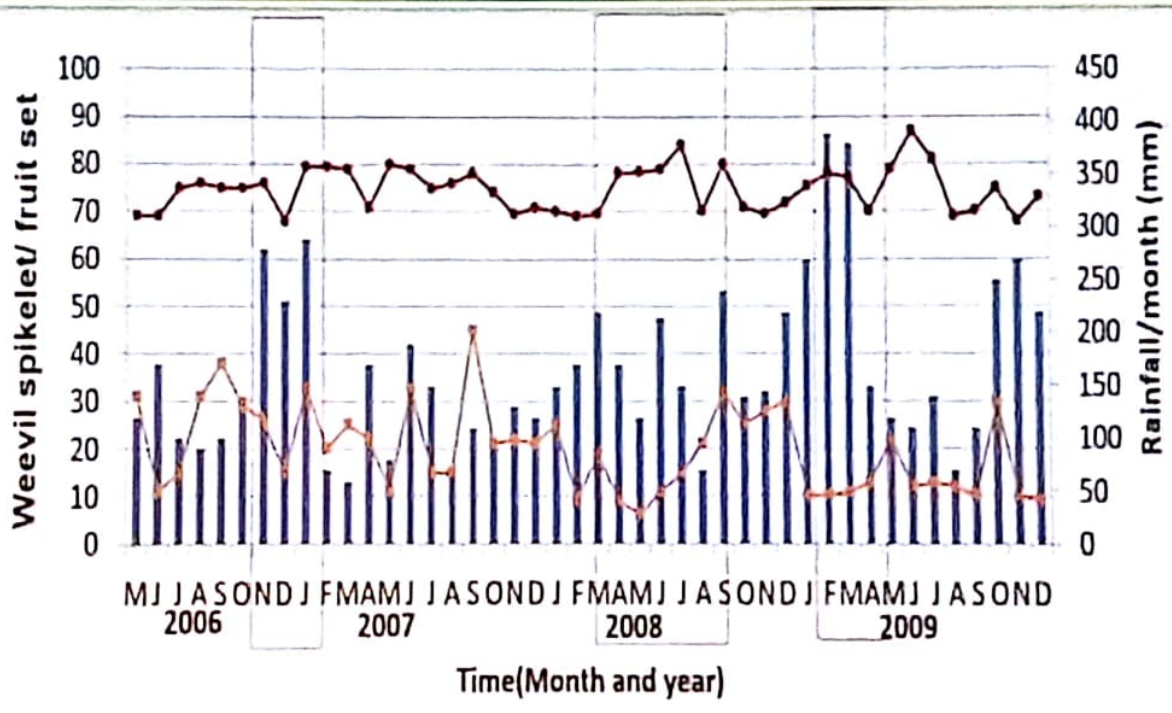


MPOB (2016)

POSSIBLE FACTORS AFFECTING POPULATION OF POLLINATING WEEVIL

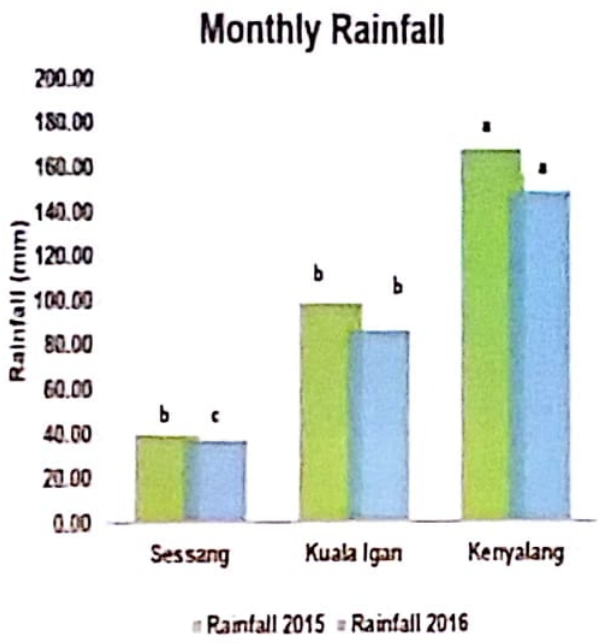
1. Climate (high rainfall) - reduced activities of the weevil
2. Natural enemies – predators & pathogens (nematodes) – reduced life span, population & weak generation
3. Narrow genetic base – reduced fecundity, life span, weak generation,
4. Infestation pests (bunch moth & rat) – competition
5. Usage of chemicals – insecticides, herbicides, fungicides etc
6. Pollen viability - due to boron deficiency ??
7. High yielding planting materials with high sex ratio – Clonal material
8. Less attractive to new planting materials – Less concentration of attractant (estragole)

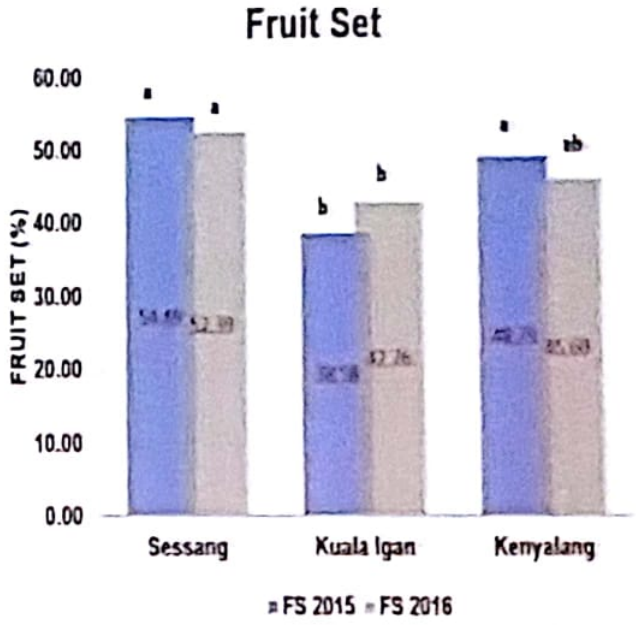
RELATIONSHIP BETWEEN WEEVIL POPULATION, RAINFALL AND FRUIT SET IN SABAH



From Mohd Rezuan et al., (2013)

EFFECT OF RAINFALL ON WEEVIL POPULATION AND FRUIT SET





EFFECTS OF NATURAL ENEMIES ON POPULATION OF WEEVIL

1. Predators – Birds (*Pycnonotus goiavier*), squirrels and rats*
2. Spiders – *Gasteracantha hasselti**
3. Insects - *Cosmolestes picticeps*, *Cantaconidae* sp*
4. Pathogens – Nematode (Poinar *et al.*, 2002)

Damage by rat

Hemiptera predator (C. picticeps)

Yellow-vented Bulbul (*Pycnonotus goiavier*)

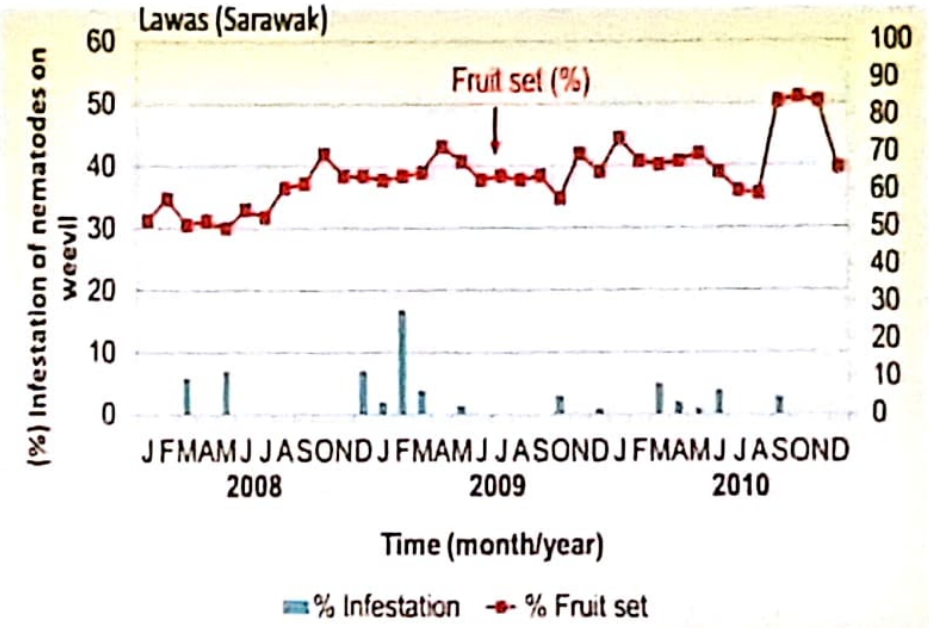
Parasitic nematode (*Elaeolenchus parthenonema*

* From Liau, (1984)

NEMATODE INFESTATION IN MALAYSIA

Locality

1. Lahad Datu (Sabah).
2. Lawas (Sarawak).
3. MPOB Keratong (Pahang).
4. Hulu Paka (Terengganu).
5. MPOB UKM (Selangor).
6. Ladang Bukit Benut (Johor)

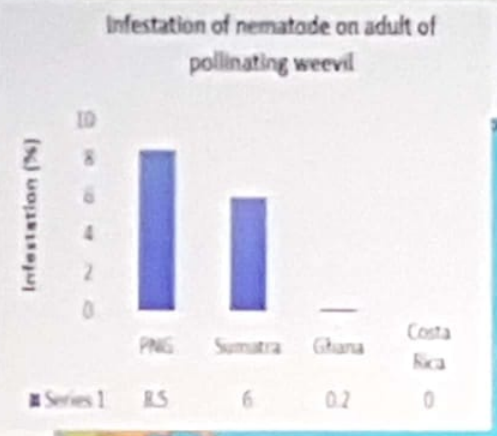


2004 – 2010, Infestation of nematodes ranging from 0.6-28%

Low incidence of nematode infestation on weevils did not affect weevil population & the fruit set. The FS level remained above 50%.

From Zulkifli et al., (2012)

NEMATODE INFESTATION ON POLLINATING WEEVIL



From Caudwell et al., (2003)

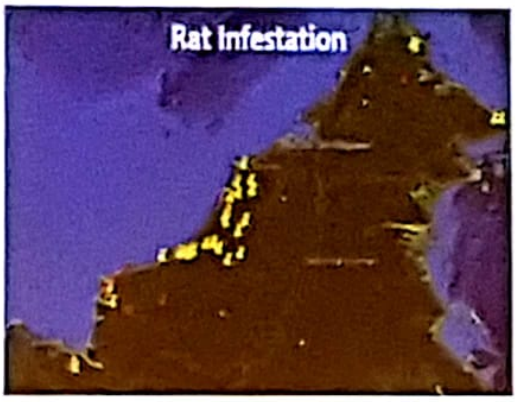
EFFECTS OF CHEMICAL AND BIOLOGICAL AGENT ON POLLINATING WEEVIL

Active ingredient	% Mortality	
	Adult*	Immature**
1. Cypermethrin	100	100
2. *B. thuriengiensis*	0	No effect
3. *B. bassiana*	8-58	No effect
4. *M. anisopliae*	22-37	No effect

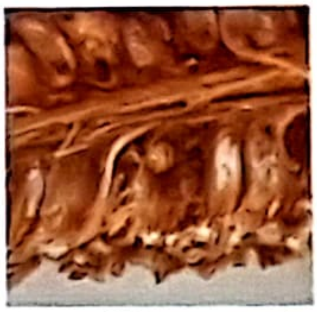
* Mortality at 6 days after treatment,
** newly emerged adults from treated spikelet

From Ramle et al., (1998; 1999)

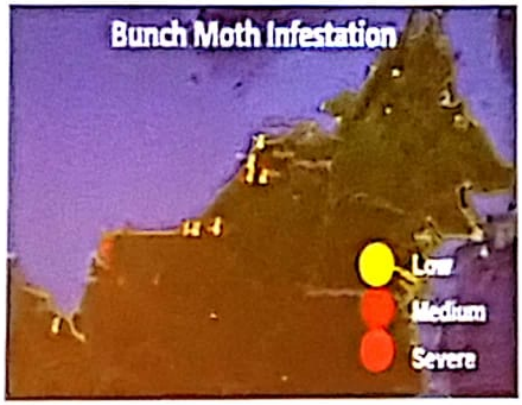
DISTRIBUTION OF PEST POPULATION IN SABAH AND SARAWAK



Male inflorescence attack by rat



Larvae of *E. kamerunicus* in male inflorescence



Tirathaba rufivena

Post anthesised male inflorescence

Damage *by T. rufivena*

ASSOCIATION BETWEEN FRUIT SET AND INFESTATION OF PESTS

Infestation of pest	Estates with fruit set problem (N 69)		Estates without fruit set problem (N 50)	
	n	%	n	%
Bunch moth	37	54.0	7	14
Rats	59	86.0	34	68.0

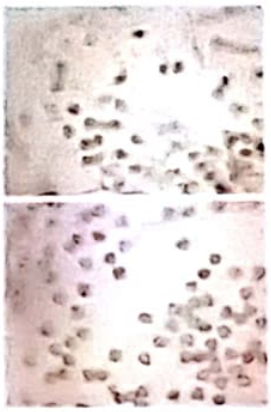
chemical control

OTHER FACTORS

1. Pollen viability
   Other plants - Boron deficiency reduced pollen gemination and male sterility.
   Oil palm – viability reduce due to climate

2. High yielding planting materials
   Clonal materials have high sex ratio (more female, less male flowers)

3. Less attractive of new planting materials
   Flowers - Less concentration attractant compounds



Geminated & none geminated of oil palm pollens

Anthesising of male inflorescence

RECOMMENDATION

1. **Young badly affected areas (<30%FS or less than 2 male flowers/ha).**
   - Hatch and carry techniques

     IMPACT

     Increase the fruit formation up to 30% and weight of fresh fruit bunches up to 8% (Eko Prasetyo & Susanto, 2015)

2. **High infestation of pests, rats & bunch moth**

   Application of non-toxic products or good agronomic practices which are safer to pollinating weevil.

3. **Planting of palm with high female traits.**
   - Integrated with palms that have more male flowers.
   - Breeding program in producing palm with stronger male traits.

RECOMMENDATION

4. Research programs in molecular aspects of pollinating weevil

- Genetic marking or profiling pollinating weevils from wider populations for greater understanding the relationship among population.
- Assist in reintroduction program of weevil from strong population to locality with weaker weevil population within countries or between continents.

5. In countries that rely on one species, in-depth research programs on the following are urgently needed

- Population dynamic, behaviour and biology of pollinating weevil
- Susceptibility of current weevil population against parasitic nematodes.
- Study on ecology, biology and distribution of parasitic nematodes.

CONCLUSIONS

1. Fruit set and production of FFB are closely related to pollinating weevil.
2. Pollinating weevil has significant contribution to oil palm industry.
3. Pollinating weevil is affected by various factors - climate, infestation of pests, application of chemicals, genetic, pollen viability & high yielding planting materials.
4. Field management should implemented good agricultural practices to improve weevil population as well as FFB yield.
5. Research on key important aspects related to pollinating weevil as well as parasitic nematode are urgently needed.