

LOW FRUIT SET AND OIL EXTRACTION RATE OF OIL PALM IN SARAWAK

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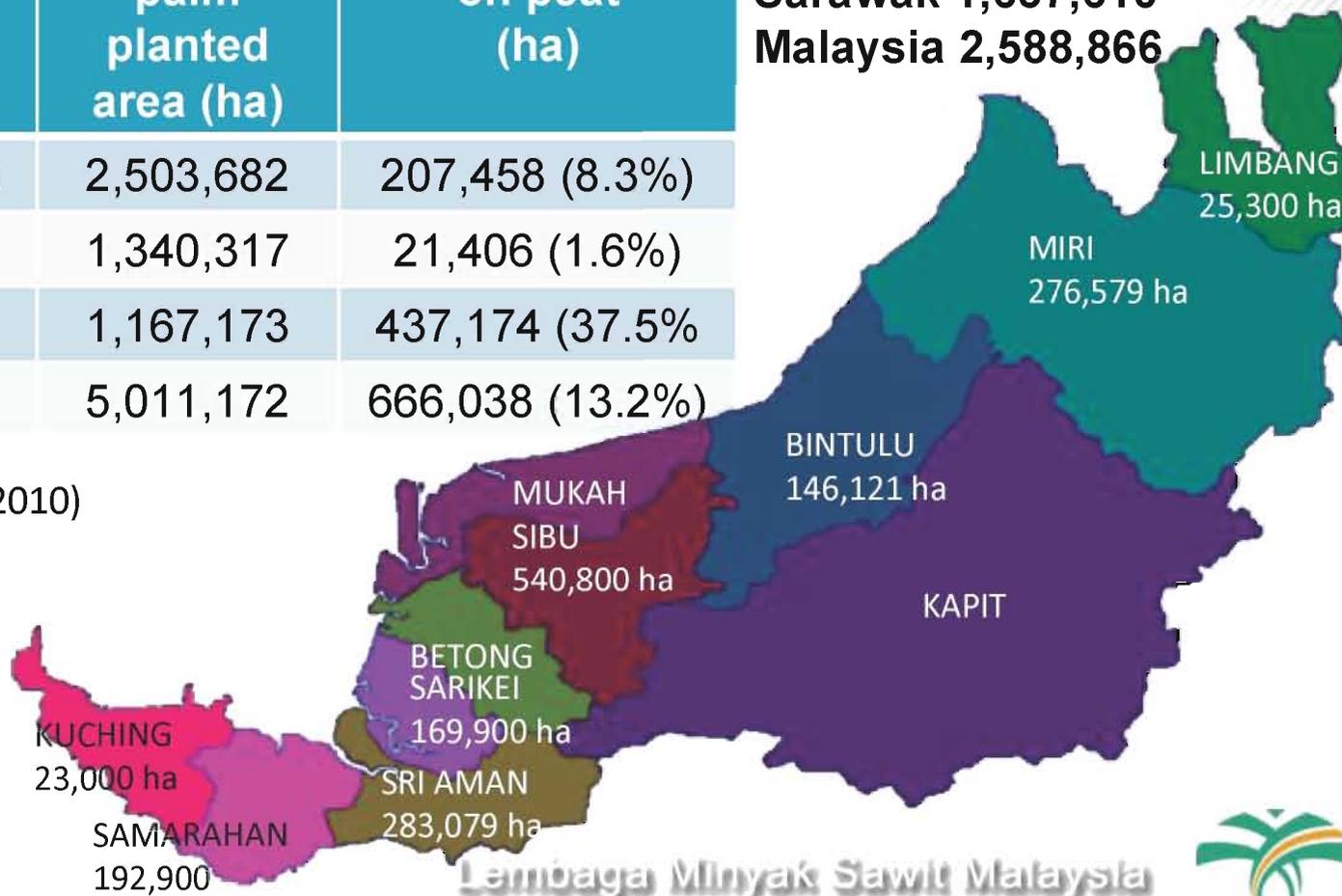
CONTENT

1. Introduction – Distribution of peatlands in Sarawak.
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 - Effects of pollination on bunch components
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3. Development of oil palm fruits and fruit set
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DISTRIBUTION OF PEATLANDS AND OIL PALM PLANTED ON PEAT

Region	Total oil palm planted area (ha)	Oil palm planted on peat (ha)
P. Malaysia	2,503,682	207,458 (8.3%)
Sabah	1,340,317	21,406 (1.6%)
Sarawak	1,167,173	437,174 (37.5%)
Total	5,011,172	666,038 (13.2%)

TOTAL PEATLANDS
 Sarawak 1,657,610
 Malaysia 2,588,866



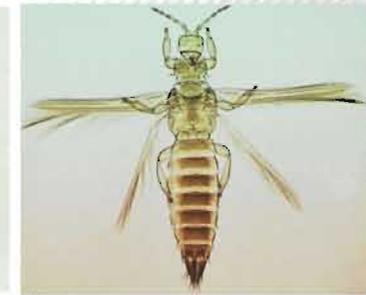
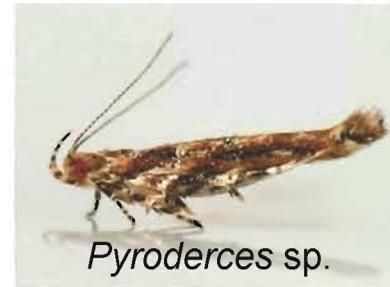
Wahid *et al.*, (2010)

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POLLINATION IN OIL PALM

- Indigenous pollinating insects :
Thrips hawaiiensis (P. Malaysia)
and *Pyroderces* sp. (Sabah)
inefficient to improve FFB yield.
- To improve FFB - assisted pollination by
hand was developed but it is labour intensive
and costly.
- Introduction of *Elaeidobius kamerunicus* into
Malaysia
 - Feb 1981. Mamor Estate, Kluang,
Johor & Pamol Estate, Sandakan,
Sabah.
 - Feb 1982 released in most estates
 - Jun 1981. Papua New Guinea
 - Dec 1981. Thailand
 - Mac 1983. Indonesia



Law & Syed (1984)

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Pollen carrying capacity, pollen load and pollen transferring ability of *E. kamerunicus*

Sex	Pollen Carrying Capacity (Number)	Pollen Load (Number)	Pollen Transferred (Number)	Pollen Transferring Ability (%)
Male	3,860	1,840	1,410	76.4
Female	2,150	1,120	780	70.2

- **Pollen Carrying Capacity**

Amount of pollen carried by weevils while congregating on anthesising male inflorescence

- **Pollen Load**

Pollen carried by weevil while entering receptive female

- **Pollen Transferred**

Amount pollen entering minus leaving the receptive female



Dhileepan (1992)

EFFECT OF POLLINATING WEEVIL ON BUNCH COMPONENTS

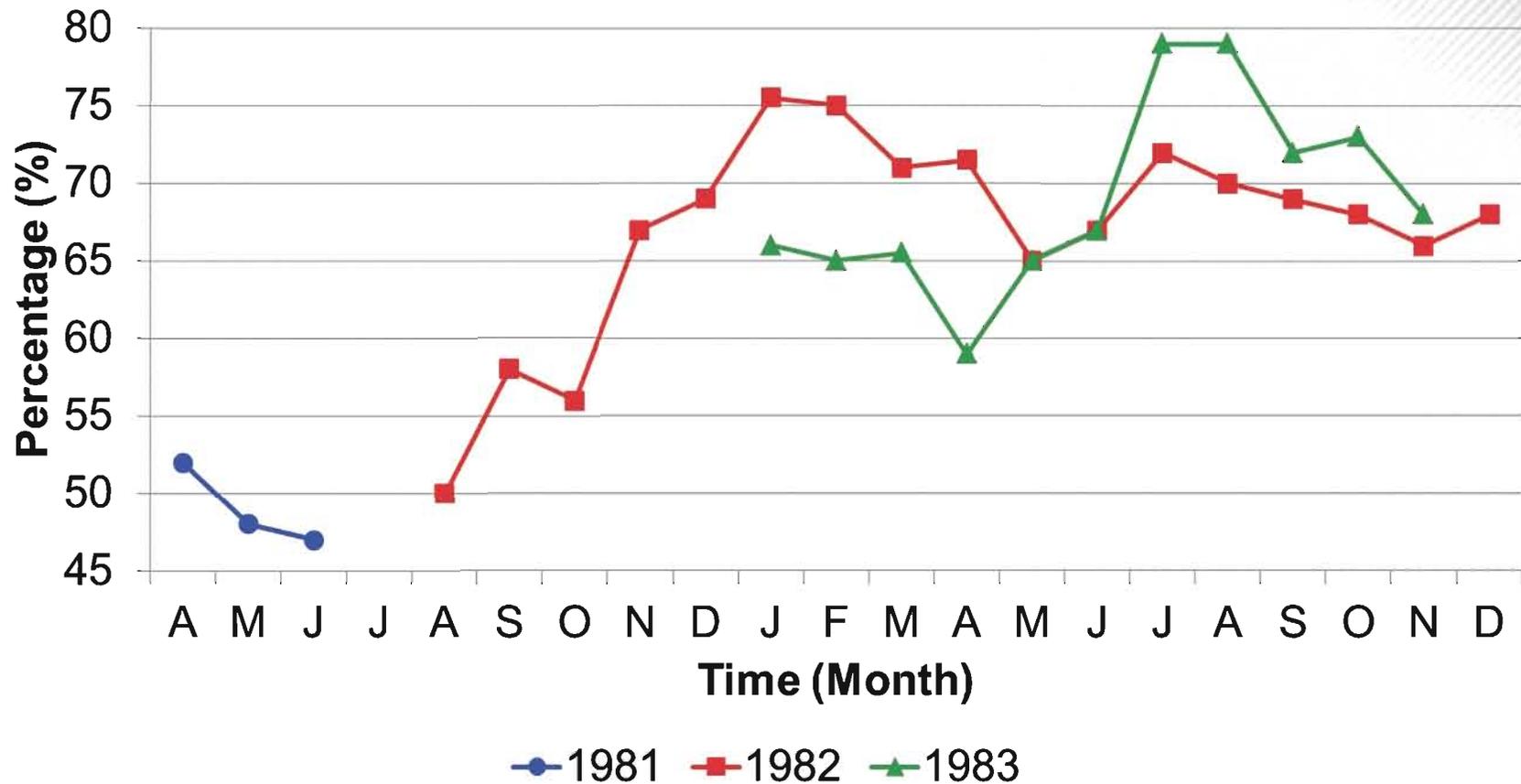
No.	Parameter	Apr - Jun 1981	Jan – Jun 1982	Jan –Jun 1983
1	B. Wt (kg)	10.8	14.5	14.5
2	F/S (%)	48.2	71.0	64.8
3	F/B (%)	57.0	64.9	63.4
4	WM/F (%)	81.3	76.8	78.3
5	O/B (%)	21.3	23.1	21.6
6	K/F (%)	8.0	10.3	9.7
7	S/F (%)	7.1	8.0	7.7
8	K/B (%)	4.7	6.8	6.3
9	M. F. Wt (g)	13.1	8.9	8.7
10	T. Oil	2.3	3.4	3.1

Law and Syed (1984)

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Effect of pollinating weevil on fruit set at Mamor Estate, Kluang



Lau and Syed, (1984)

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DEVELOPMENT OF OIL PALM FRUITS



FRUIT SET



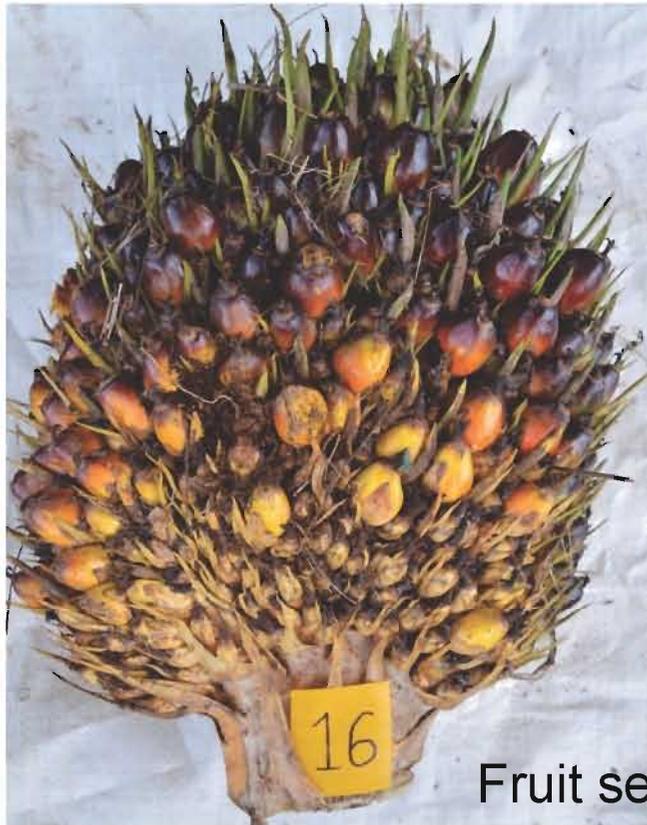
Fertile
Fruits

Parthenocarpic
fruits

$$\text{Fruit Set} = \frac{\text{Number of fertile fruit}}{\text{Total numbers of fruits in bunch}}$$

BUNCH WITH LOW FRUIT SET

Fertile	= 188
Parthenocarpic	= 416
Total	= 604
Weight	= 9.4kg



Fruit set = 31.13%



BUNCH WITH HIGH FRUIT SET

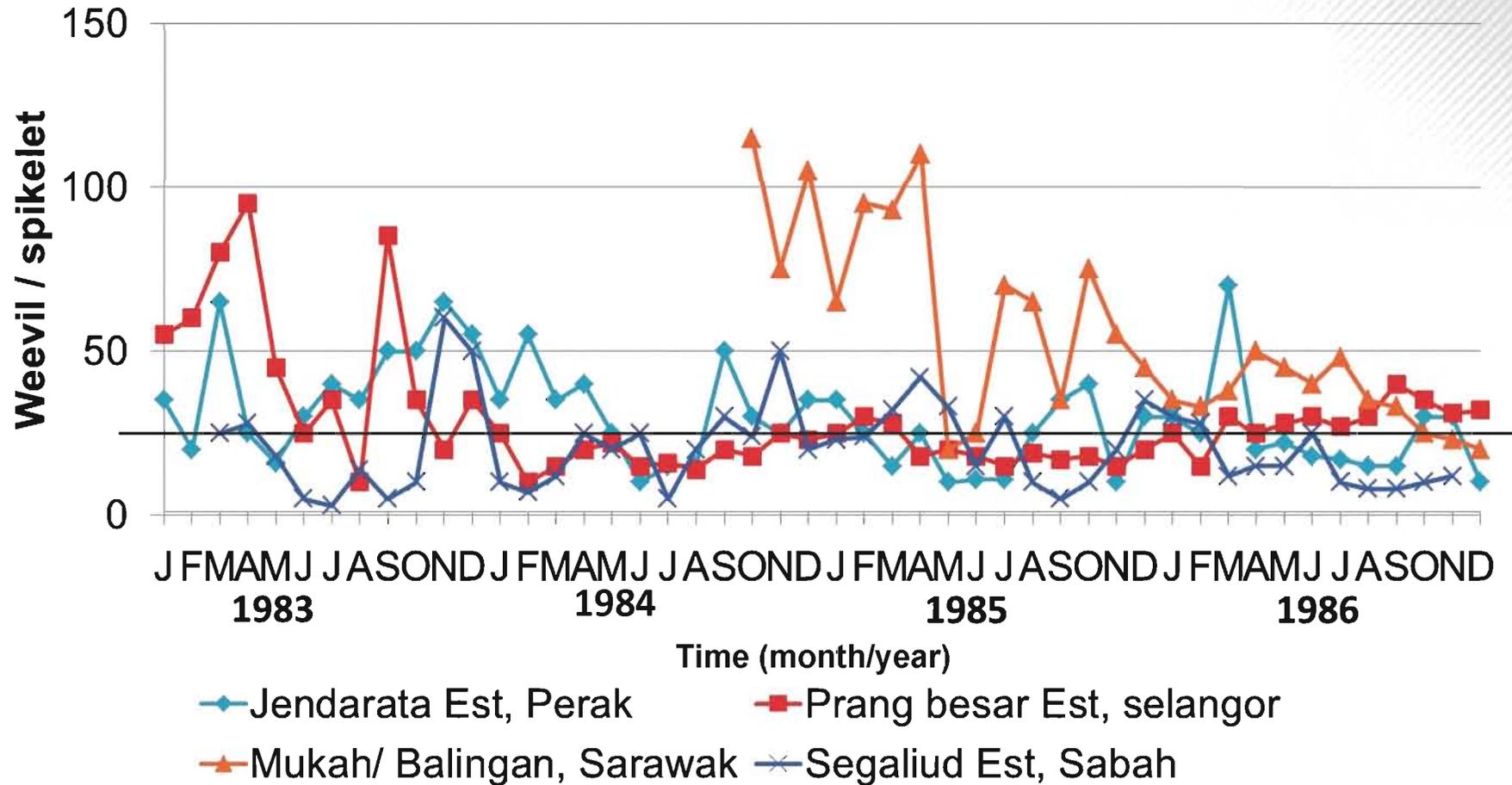


Fertile	= 349
Parthenocarpic	= 136
Total	= 485
Weight	= 12.0kg



Fruit set = 71.69%

Pollinating weevil population from 1983 to 1986



Basri et al., (1987)

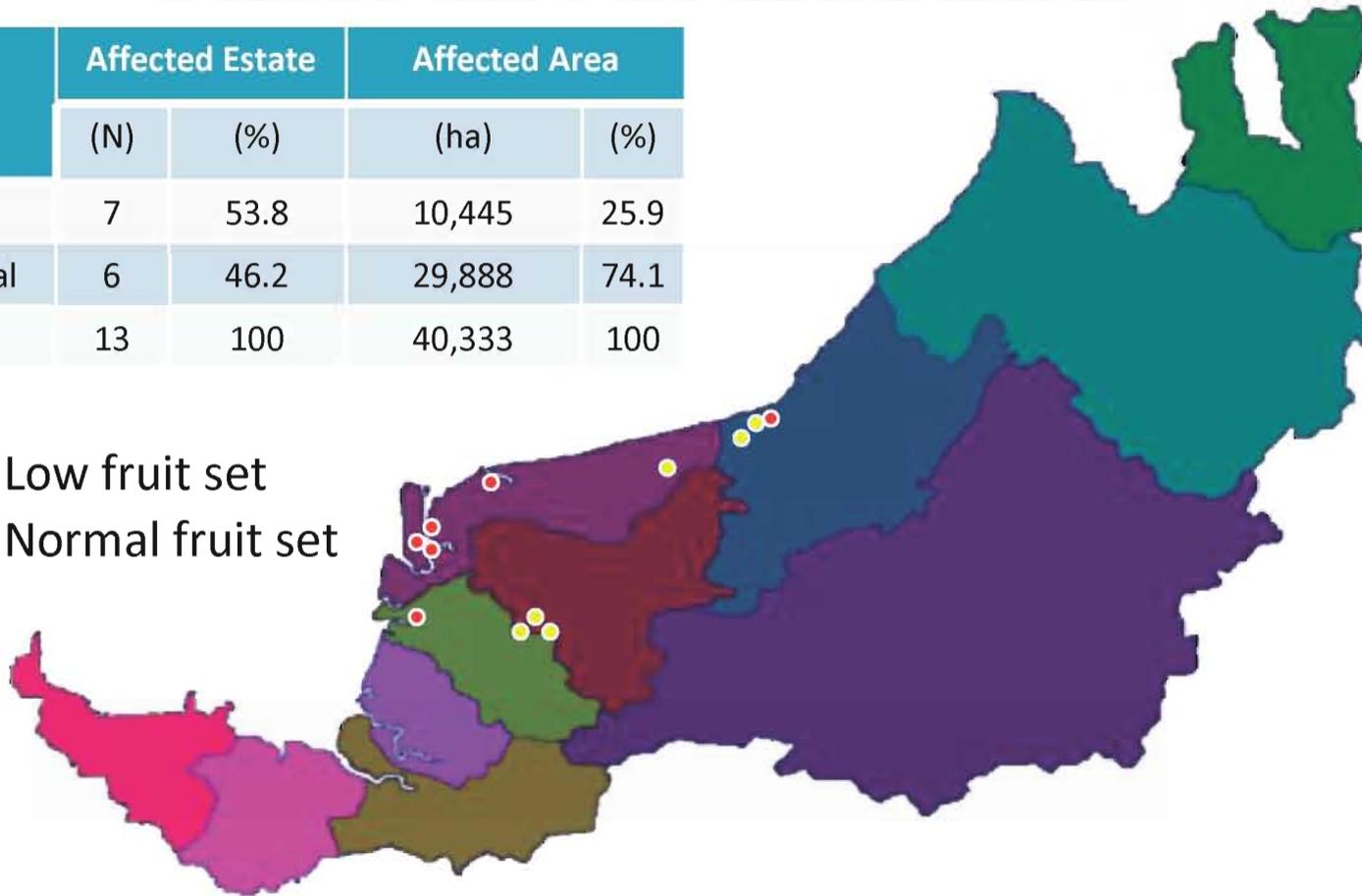
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DISTRIBUTION AREAS WITH LOW FRUIT SET IN SARAWAK

Fruit Set Issue	Affected Estate		Affected Area	
	(N)	(%)	(ha)	(%)
Low	7	53.8	10,445	25.9
Normal	6	46.2	29,888	74.1
Total	13	100	40,333	100

- Low fruit set
- Normal fruit set



Survey (2016)

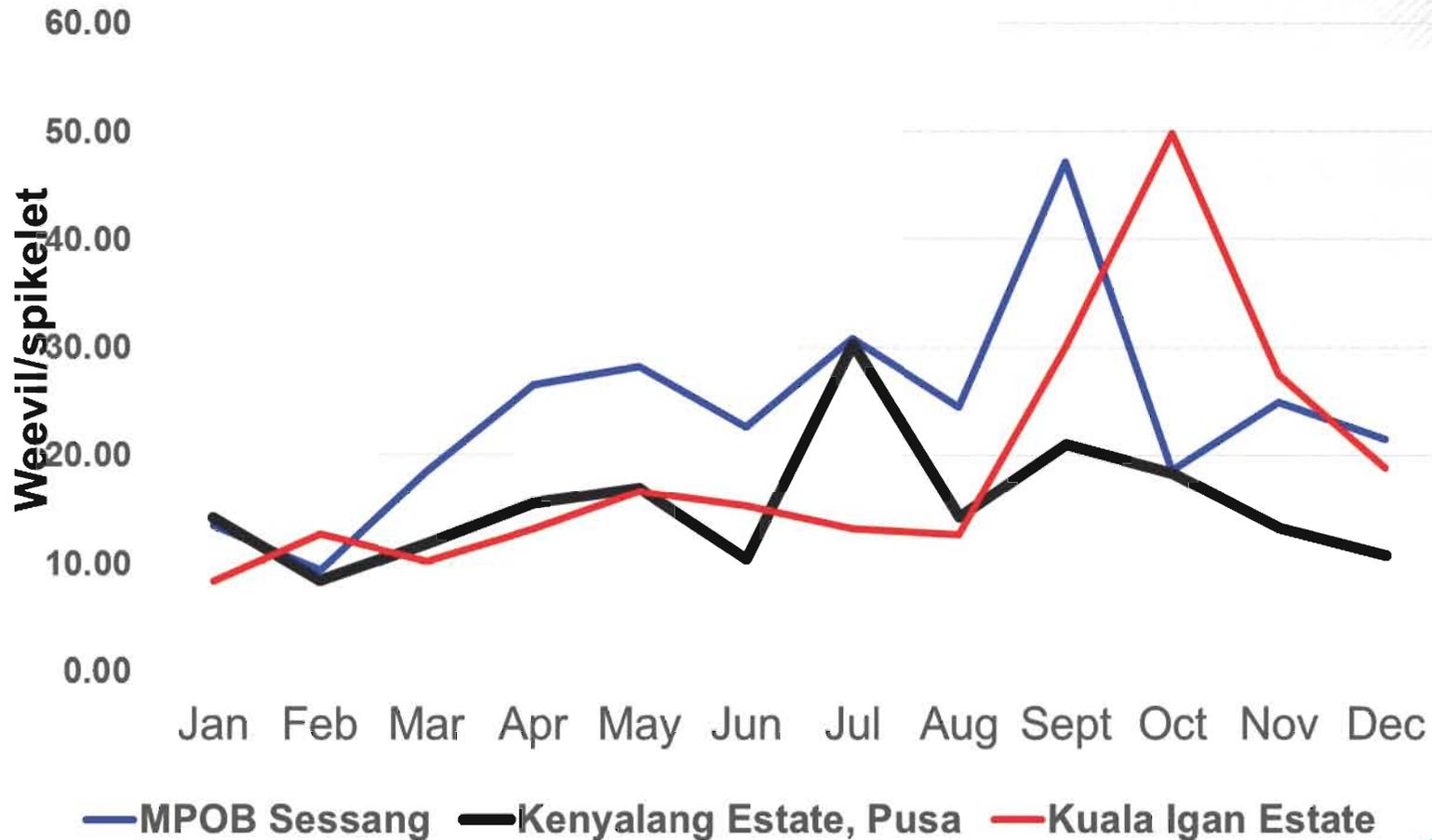
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POPULATION OF *E. kamerunicus* IN THREE LOCALITIES IN SARAWAK



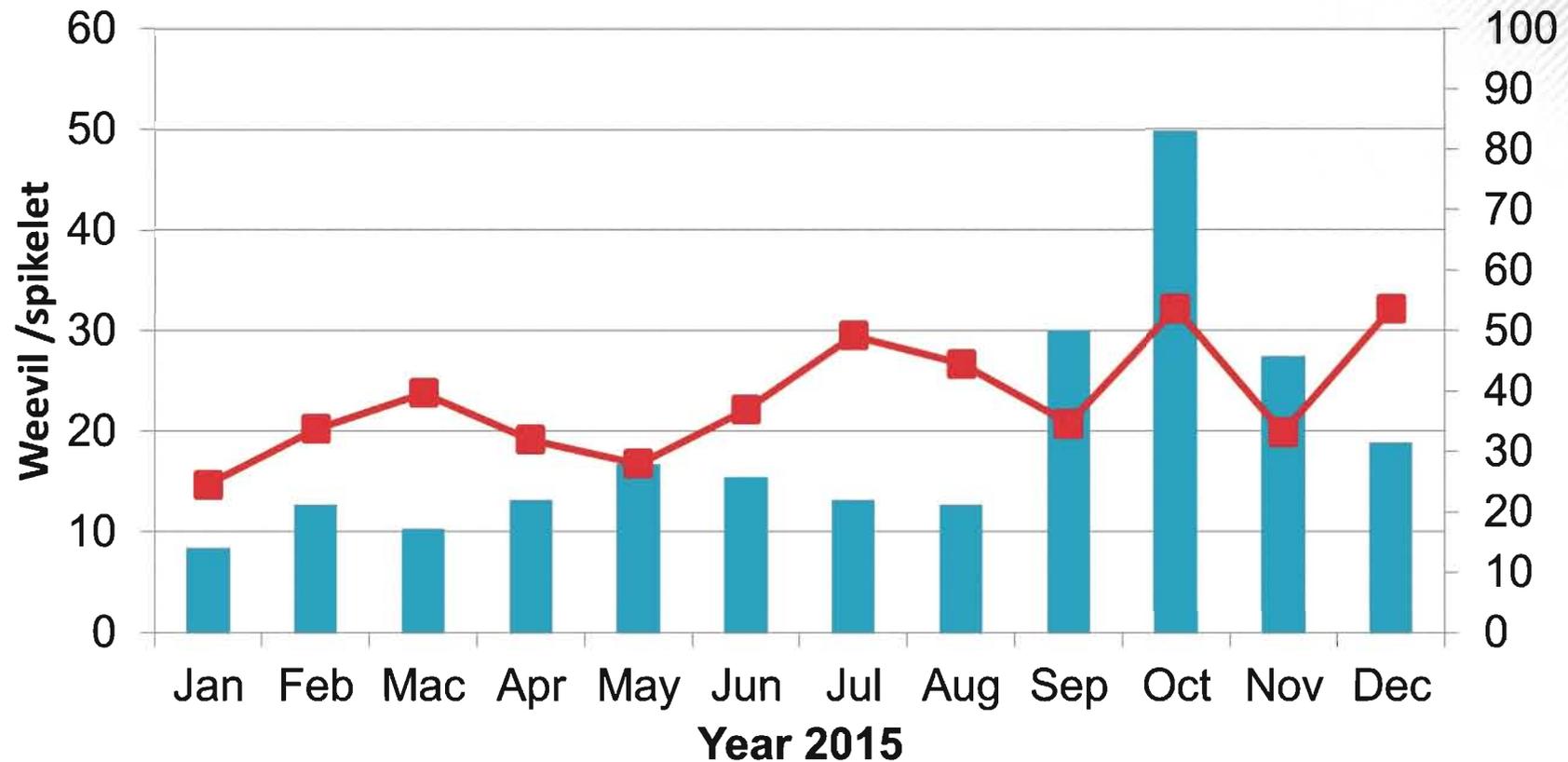
POPULATION OF *E. kamerunicus* IN THREE LOCALITIES IN SARAWAK, 2015



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POPULATION OF *E. kamerunicus* AND FRUIT SET IN 2015



■ Weevil population ■ % Fruit set

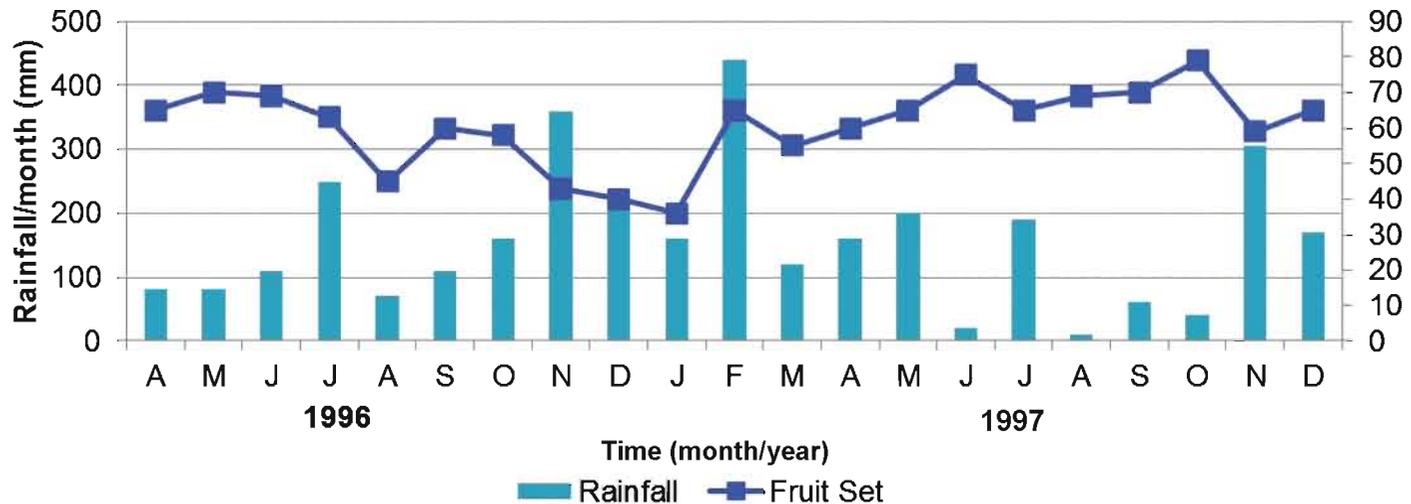
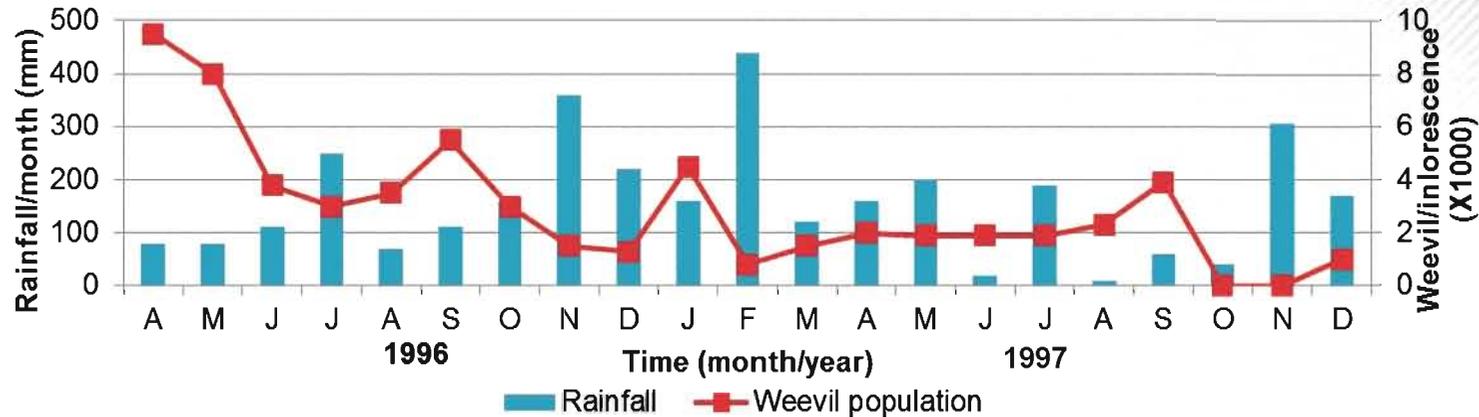
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Possible factors affecting pollinating weevil

1. Climate (high rainfall, haze, el-nino etc)
2. Natural enemies – predators & pathogen (nematodes) – reduce life span.
3. Narrow genetic base – reduced fecundity, life span, weak generation, etc.
4. Competition with other pests
5. Usage of chemicals – insecticides, herbicides, fungicides etc.
6. Pollen viability due to boron deficiency.
7. High yielding planting materials with high sex ratio – D X P, Clone, Interspecific hybrid
8. Less attractive to new planting materials

Effect of rainfall, population of weevil and fruit set at Lahad Datu, Sabah



FS values recorded at 6 moths after the rainfall data were collected

Basri *et al.*, (1998)

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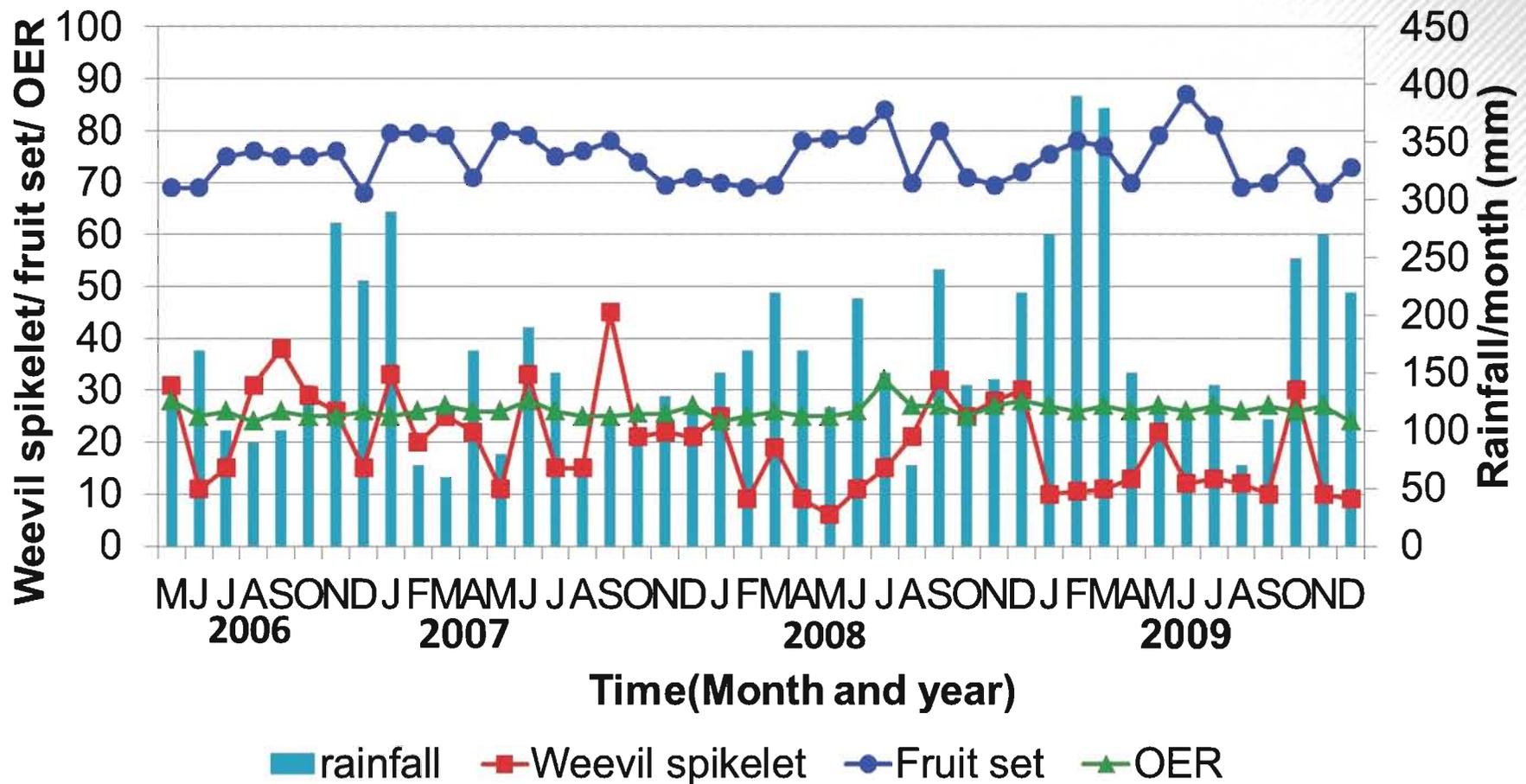


COMPARISON ON LIFE TABLE OF POLLINATING WEEVIL

Stage	Study in 1981	Study in 1991**
Eggs	< 1	2.02
Larva I	< 1	1.20
Larva II	1	1.16
Larvae III	6	1.29
Pupa	3	1.33
Adult	M 11 – 13 F 10 - 11	?
L. Expectancy	23 - 25	?
Gen. Time (T)	19.4	15.4
Repro. Rate	32.3	?

* Syed (1981) ** Hussien & Rahman (1991)

Relationship between population of weevil with rainfall, fruit set in Sabah



Mohd Rezuan *et al.*, (2013)

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Effect 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)**



C. picticeps



Yellow-vented Bulbul

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*Bettycopa *et al.*, (2015), **Chung (2015), ***Liau, (1984)



Pathogen - Nematode

Parasitic nematode, *Elaeolenchus parthenonema*

Female nematode infecting larvae & adult weevil.

Reduced lifespan (Poinar *et al.*, 2002)

Infestation due to low genetic diversity of weevil population

Long term study - 2002 to 2010 (Zulkifli *et al.*, 2012)

Lahad Datu (Sabah), Lawas (Sarawak)

MPOB Keratong (Pahang), MPOB Hulu Paka (Terengganu)

MPOB UKM (Selangor)

Ladang Bukit Benut (Johor)

Conclusion

Nematode infestation on weevils did not affect the fruit set. The FS level remained above 58%



GENETIC VARIATION OF *Elaeidobius kamerunicus**

RAPD-PCR method, 10 mers primers, 10 primers

1. MPOB UKM, Selangor
2. MPOB Kluang, Johor
3. MPOB Hulu Paka, Terengganu
4. Gambang Estate, Pahang
5. Serting Estate, N. Sembilan
6. MPOB Lahad Datu, Sabah
7. Terusan Estate, Sandakan Sabah
8. Merotai Estate, Tawau Sabah
9. Sipit Estate, Tawau Sabah

Conclusion

Weevil population in Sabah and P. Malaysia is closely related

* Ramle *et al.*, (1998), unpublished data

GENETIC VARIATION OF *Elaeidobius kamerunicus*

M - 9 8 7 6 5 4 3 2 1 - 9 8 7 6 5 4 3 2 1 M



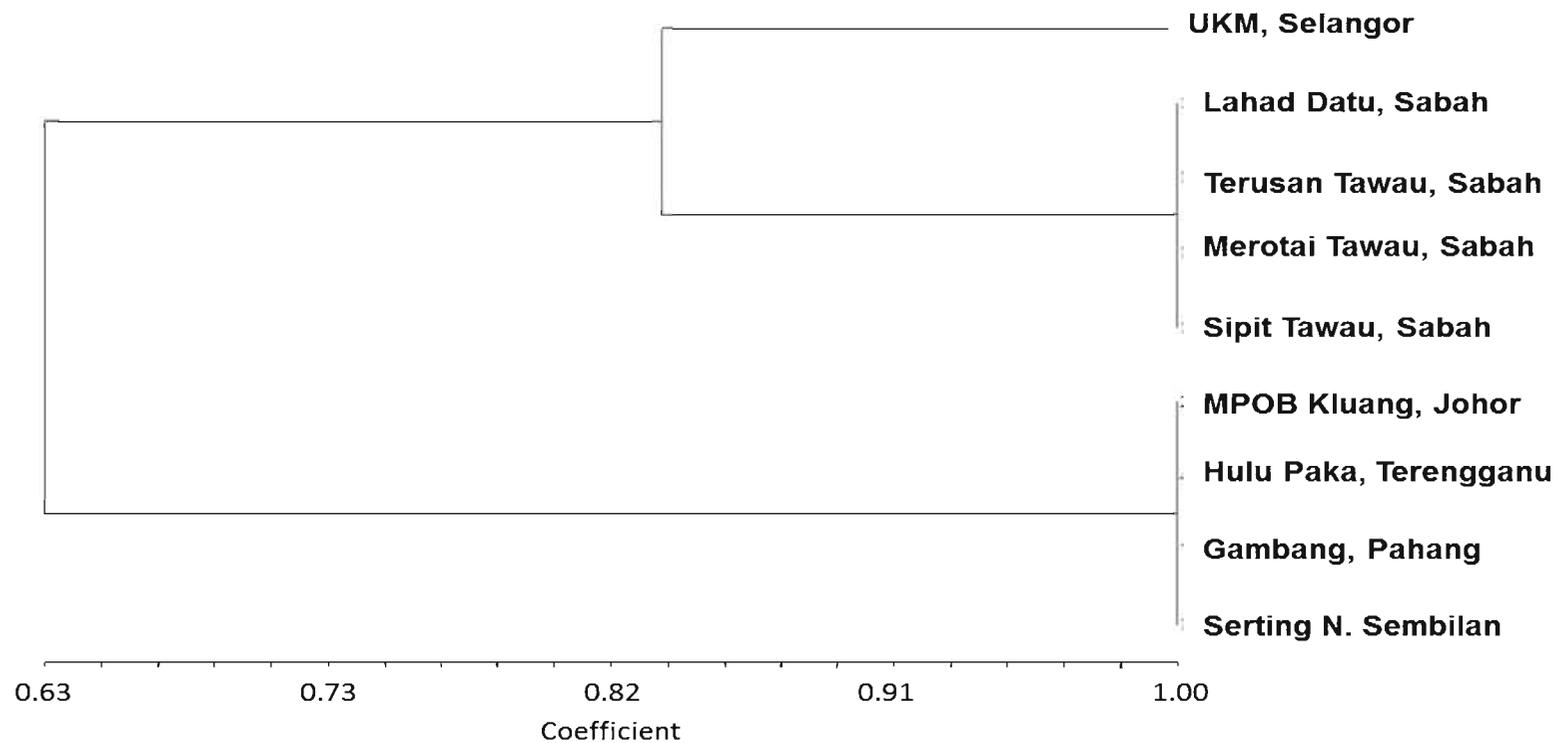
Primer 45

Primer 48

Identical DNA profiles - 4 primers

Different DNA profiles - 6 primers

GENETIC VARIATION OF *Elaeidobius kamerunicus*



Dendrogram generated from primer 16

EFFECT OF CHEMICALS AND BIOLOGICAL AGENTS ON POLINATING WEEVIL

No	Active ingredient	Mortality of adult* (%)	Emergence of adult** (%)
1	Cypermethrin	100	0
2.	<i>B. thuriengiesis</i>	0	100
3.	<i>B. bassiana</i>	8 – 58	100
4.	<i>M. anisopliae</i>	22 - 37	100

* At 6 days after treatment,

** Newly emerged adults from treated spikelet

Ramle et al., (1998; 1999),

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PRELIMINARY ASSISTED POLLINATION STUDY



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RESULT OF ASSISTED POLLINATION STUDY

Month	Percentage of Fruit Set										
	1	2	3	4	5	6	7	8	9	10	Mean
Feb 2015	31.5	75.3	41.3	62.4	25.5	25.2	51.7	61.8	71.8	64.8	51.11
Apr 2015	52.1	38.5	35.1	55.9	13.1	21.7	43.0	2.3	64.8	50.4	41.26
May 2015	25.1	4.1	60.4	2.0	73.4	Na	Na	Na	Na	Na	52.96

Feb 2015	Apr 2015	May 2015
33.78	32.00	27.99

IMPROVING OF WEEVIL POPULATION VIA HATCH & CARRY TECHNIQUE*

1. Hatch and carry technique



Methods – distance between box 400m, 6-9 PAMI/box
New emerged adults, sprayed with pollen (>60%), rate
1g/box/d, release time 8-10am, 15 boxes/worker (250-
230ha/worker)

Results – FS increased by 30% and even higher
N. Sumatra – FS increased from 67.7% to 88.6%

*Eko Prasetyo & Susanto (2015)

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IMPROVING OF WEEVIL POPULATION VIA HATCH & CARRY TECHNIQUE*

2. Hatch and carry mobile technique



Methods – New emerged adults in bags sprayed with pollen (>60%), bags were distributed to harvester, released time 8-10am.

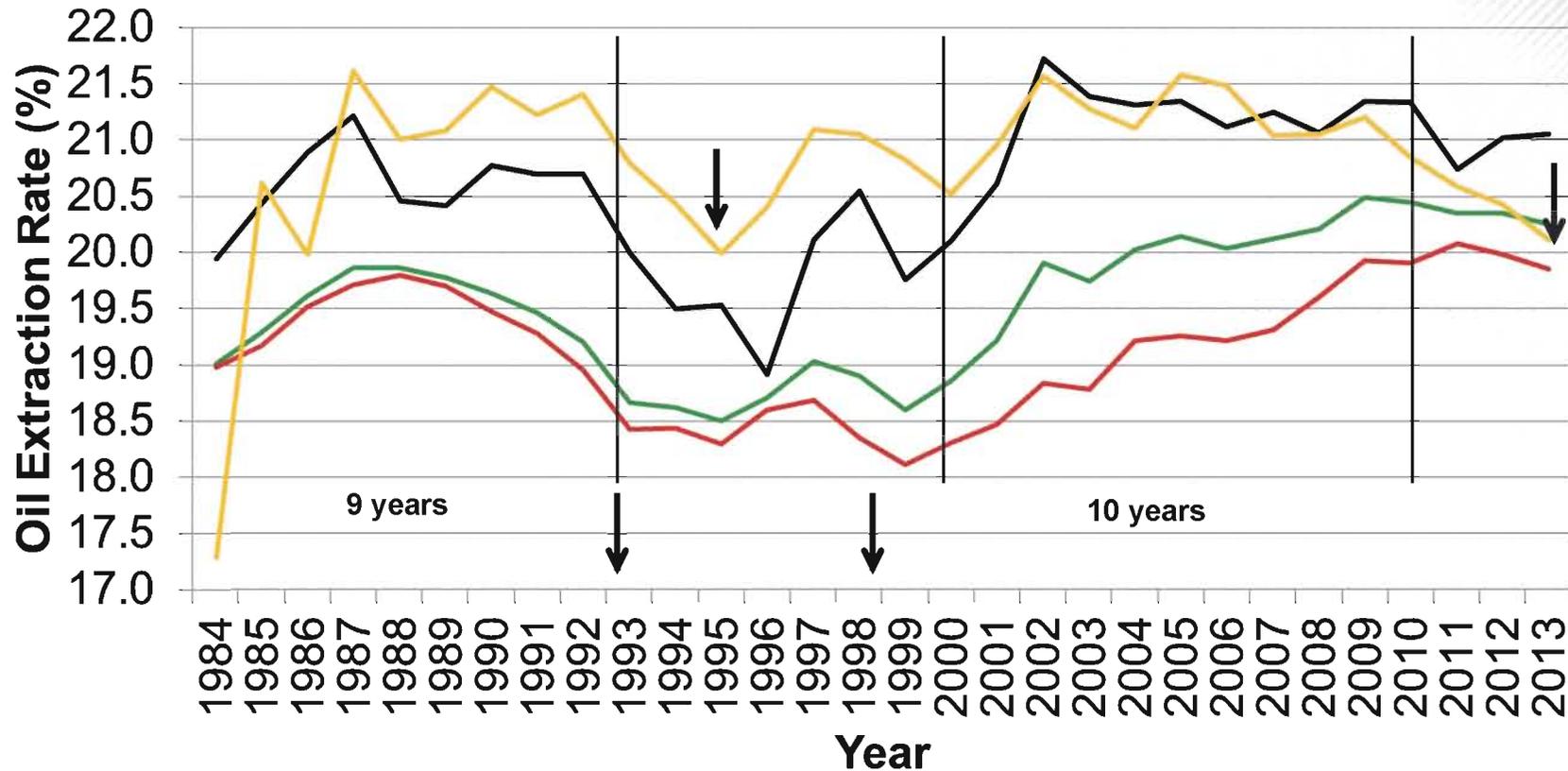
Results – FS increased by 17-26% for 6 months
BW increased by 7.75%, Yield/ha increased by 8.41%

*Eko Prasetyo & Susanto (2015)

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Trend in Oil Extraction Rate (OER) from 1984 to 2013



— Malaysia — Peninsular Malaysia — Sabah — Sarawak

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FACTORS AFFECTING OER IN THE COASTAL REGION OF SARAWAK

Survey between March-April 2014

**Involving 53 estates (166,146 ha), 162 Smallholding (972ha)
and 10 mills**

Estate factors

1. Weather pattern, Planting material, Fertilizer, Agricultural practices (Harvesting, loose fruit collection, bunch stalk), Pests and diseases and Transportation

Mill factors

1. Sterilization station (types, processes), Tresher, Press station, Dilution crude oil tank, Clarification station, Sludge separator, Storage tank, Data oil losses

Oil extraction rate of mills in coastal and inland regions, 2008 to 2013

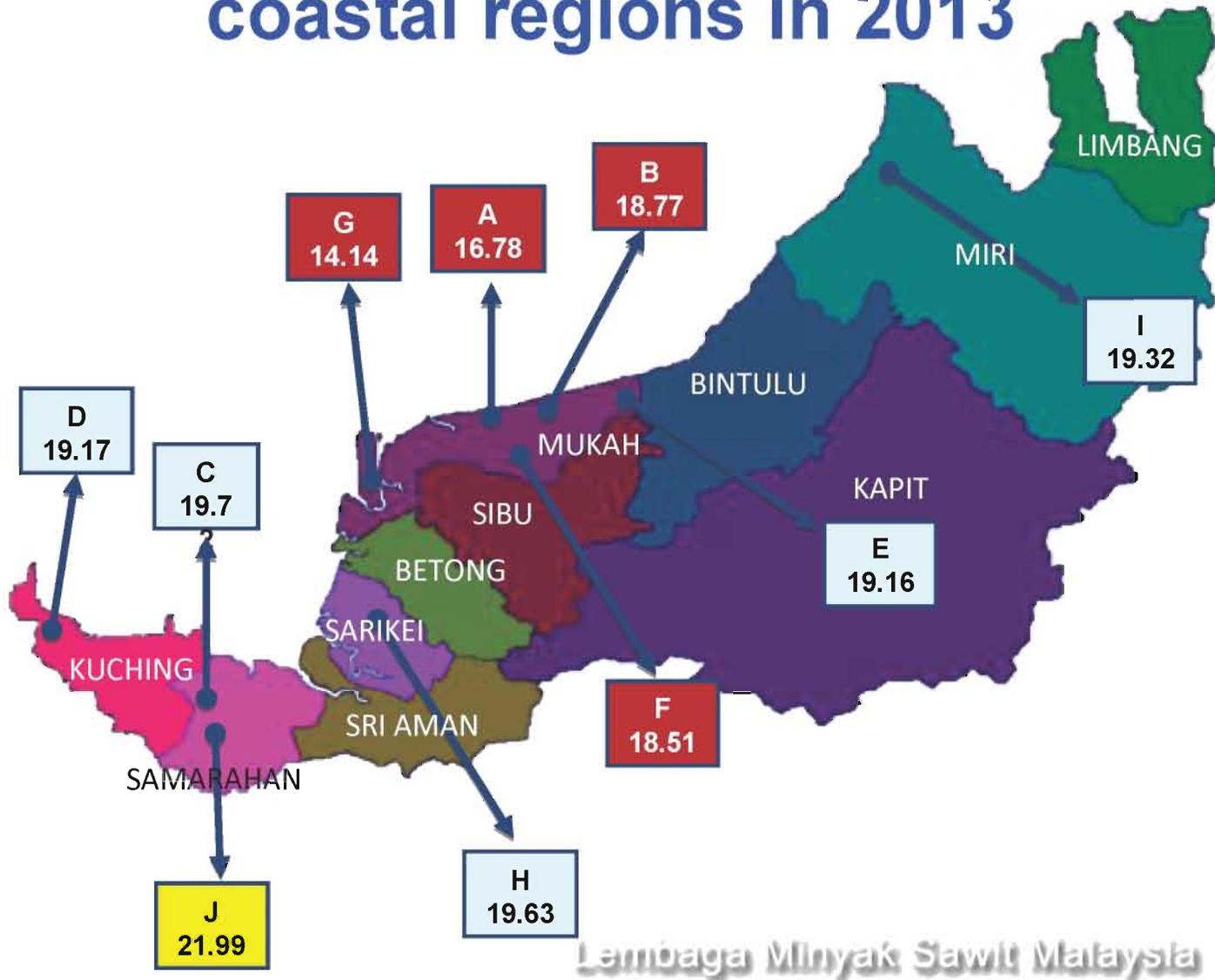
Year	OER of Mills in Coastal (%)	OER of Mills in Inland (%)	Total (%)	Difference
2008	20.25	21.11	21.05	- 2.18
2009	20.47	21.51	21.20	- 4.83
2010	20.16	21.17	20.85	- 4.77
2011	20.08	21.03	20.59	- 4.52
2012	19.85	21.04	20.43	- 5.66
2013	19.63	20.62	20.12	- 4.80

Kushairi *et al.*, (2014)

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Oil extraction rate of 10 mills in the coastal regions in 2013



Kushairi *et al.*, (2014)

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Estate factors affecting OER of oil palm

No	Variable	T Statistic
1.	Estate OER 2012 (%)	7.879***
2.	Mill OER 2013 (%)	9.275***
3.	Planted Area (ha)	2.768***
4.	Labour (persons)	1.340ns
5.	Harvesting round/month	2.612**
6.	Soil types (1-peat, 0-mineral)	-2.771***
7.	Rainfall 2012 (mm)	2.829***
8.	Fertilizer type (1-comp only, 0-others)	-3.579***
9.	Termite (1-yes, 0-no)	-2.048**

F=33.827***, R²=0.901, n=53

Kushairi *et al.*, (2014)

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Milling factors affecting OER of oil palm

No	Variable
1.	High proportion of low quality FFB (unripe & under ripe bunches)
2.	High in oil losses in 4 mill processes - Sterilizer condensate, press cake fibre, sludge ex-separator and after thresher
3.	Mill utilization rate above capacity

CONCLUSION

- Understanding on possible factors affecting population of weevil for better plantation management.
- Monitoring of pollinating weevil and fruit set, especially in hot spots (Low fruit set & OER)
- Improve field management through implementation of good agricultural practices.
- Assisted pollination may be practiced in badly affected areas with low pollinating weevil and fruit set
- Improve yield and quality FFB via good agricultural practices (GAP).
- Improve oil recovery by adopting good milling practices

Thank You
Thank You



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