



MINISTRY OF AGRICULTURE AND AGRO-BASED INDUSTRY MALAYSIA
KUALA LUMPUR
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TECHNICAL DOCUMENT

FOR MARKET ACCESS



ON PINEAPPLE (*Ananas comosus*)



CROP PROTECTION AND PLANT QUARANTINE SERVICES DIVISION
DEPARTMENT OF AGRICULTURE
KUALA LUMPUR
MALAYSIA

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PINEAPPLE

AGRONOMIC ASPECTS

Name of Crop: **Pineapple**
Botanical Name: ***Ananas comosus L. Merrill***
Family: **Bromeliaceae**
Common Name: **Nanas**

Introduction

Pineapple is a tropical crop believed to be originated from South America. Pineapples are widely grown in Thailand, Philippines and South Africa.

In Malaysia, total area of about 11,684 ha. was planted with pineapple with a production of about 265,680 tonnes (year 2000). The major producing states are Johor, Kelantan and Pulau Pinang.

Pineapple is normally consumed fresh or can be processed as canned pineapple or juice. The export volume for fresh pineapple is about 18,500 tonne amounting to about RM9.6 million in year 2000. The major market is Singapore, with a small amount going to Hong Kong and Middle East countries.

Nutrient Composition of pineapple is as follows:

Nutrient	per 100 gm edible portion
Energy	45.0 Kcal
Water	87.8 gm
Protein	0.5 gm
Fat	0.1 gm
Fibre	10.6 gm
Ash	0.6 gm
Calcium	0.4 mg
Phosphorous	24.0 mg
Iron	6.0 mg
Sodium	1.4 mg
Potassium	31.0 mg
Beta Carotene	40.0 mg
Vit B1	270.0 mg
Vit B2	0.17 mg
Niacin	0.1 mg
Ascorbic Acid (Vit C)	15.2 m g

CROP REQUIREMENT

Climate

Pineapple is a xerophytic plant which can withstand drought. It is adaptable in areas with annual rainfall between 500 - 3000 mm.

Soil

Pineapple can be grown on a variety of soils ranging from alluvial soils to acid sulphate and peat soil with good drainage.

VARIETIES/CLONES

The characteristics of commercially planted pineapples varieties are as follows:

Varieties	Fruit weight (kg)	Characteristic
1. Sarawak	2 - 4	<ul style="list-style-type: none">• Use for canning as well as table• Vigorous plant, growing up to 120 cm high with 60 - 80 leaves at flowering.• Leaves are spiny at tip• Fruit are green to copper in colour• Flesh is pale yellow . Taste is sweet with 14 - 17 ° brix
2. Gandol	1.5	<ul style="list-style-type: none">• plant of medium size with erect leaves and sparsely spiny towards the tip• fruits are dark purple in colour• flesh is golden and translucent. Taste is insipid. Brix 8 - 15°
3. Mauritius	0.5 - 1.5	<ul style="list-style-type: none">• Plants are small with dark bluish green spiny leaves.• Fruits are dark green in colour• Flesh is yellow. Taste is sweet with brix 15 - 17°
4. N36	1.5 – 2	<ul style="list-style-type: none">• Hybrid between Gandul (Spanish) and Smooth cayenne• It is a very robust cultivar with large crown• Brix 14° and flesh is pale yellow
Josapine	1.1 – 1.3	<ul style="list-style-type: none">• Hybrid between Johor (spanish) and Sarawak (Smooth Cayenne)• Leaves are lightly purple-tinged, with spineless margins• Crown are medium in size• Fruit is cylindrical shape with dark purple peel ripening to attractive orange red.• Flesh colour is deep golden yellow with strong aroma• Brix 17 - 22°

VARIETIES/CLONES IN MALAYSIA



GANDOL



HIJAU

Source: Malaysian Pineapple Industry Board (MPIB)



JOSAPHINE



MORIS

Source: Malaysian Pineapple Industry Board (MPIB)



N36



SARAWAK

Source: Malaysian Pineapple Industry Board (MPIB)

CULTURAL PRACTICES

Planting

Pineapple is normally propagated vegetative using crowns (tops) and suckers such as base suckers, ground suckers and aerial suckers. It is planted at a distance of 30 cm x 60 cm x 120 cm giving a planting density of about 37,000 plants/ ha.

Fertilization

Fertilizers are applied in the form of foliar sprays and also as ground broadcast. For peat soil, the mixture normally used for ground broadcast has a nutrient ratio of N: P₂O₅:K₂O at 30: 1: 32.. To every 600 kg of the mixture, 2 kg of copper sulphate and 2 kg of zinc sulphate are added. This fertilizer is applied at 2,4 and 6 months after planting at a rate of 14 g/ plant per application. Foliar sprays of micronutrient are given at 1.5 and 3 months after planting.

Fertilizer requirement for pineapple grown on mineral soils are slightly different compared with peat. General guidelines for fertilizer application on mineral soils should be based on the N : P₂O₅: K₂O: Mg formulation of 15: 15: 15 at 860 kg/ha application given at 2 and 4 months after planting. At 6 months after planting, the formulation should be changed to 12: 12: 17: 2 at the same rate.

Weed Management

For the first six months of new planting, attention should be given to weeding. Once the pineapple plants are bigger the weeds should be shaded out and less weeding required. It is normal practice to use combination of manual and chemical weeding in controlling weeds.

Plant Growth Hormones

Flower induction is commonly practiced in pineapple plantation, as natural flowering in pineapple is rather variable and unpredictable. Commercially produced pineapples are induced to flower in synchrony so that harvesting can be done in one operation. Flower inducing hormone such as ethephon is generally used. Flower induction is normally done at 7 – 9 months after planting depending on the variety.

Decrowning

Malaysian pineapple of Josapine variety is specially selected for export for table because of its sweetness, yellow flesh and small crown. The small crown of the Josapine is due to the decrowning process, whereby the crown of the fruit is mechanically spiked at early fruit stage to make the flesh more compact and increases the weight. This process will eventually reduce the size of the crown, hence reduces the risk of pests and weed seeds harbouring onto it.

MATURITY AND HARVEST

Maturity

Pineapple can be harvested between 115 – 170 days after flowering depending on varieties as well as the destination of the market. Average yield of popular varieties planted are as follows:

Mauritius - 20 ton/ha, Sarawak - 40 ton/ha , Gandul - 60 ton/ha , N36 – 45 ton/ha, Josapine – 35 ton/ha

The ripening stages of pineapple can be divided into 7 maturity stages. Most of the varieties can be harvested at maturity stage 2, but for N 36, it can only be harvested at maturity stage 3. Harvesting for nearby markets or export by air can be done at more advanced stage i.e at stage 4 or 5.

POST HARVEST HANDLING AND STORAGE

Post harvest handling

Fruits are harvested manually by cutting the stalk using sharp knife. Normally about 3.0 cm of the peduncle is left attached to the fruit during harvesting. The harvested fruits are put inside gunny sacks or bamboo basket and send to the collecting centre for grading.

Storage

Pineapple fruit should be distributed immediately after harvesting since storage life of pineapple is about 4-5 days only in ambient temperature (25 - 35°C). For long distance market fruit should be stored at temperature 8 – 10°C to extend the shelf life to 4 – 5 weeks.

PINEAPPLE IN THE FIELD



DISCOVERING MALAYSIAN FRUITS

Pineapple

Ananas comosus

The crown and triangular-shape give the pineapple an instantly recognizable appearance. The juice is a very popular and refreshing drink. It is also a good natural source of vitamins and minerals.



Cut off the crown and base.



Pare away the outer skin deeply.



Cut the fruit into required pieces.



Slice sectionally and serve with a fork.

Source: Federal Marketing Authority (FAMA), Ministry of Agriculture Malaysia

DISCOVERING MALAYSIAN FRUITS



Source: Federal Marketing Authority (FAMA), Ministry of Agriculture Malaysia

***PESTS (INSECT) LIST
OF
PINEAPPLE***

PESTS LIST OF PINEAPPLE IN MALAYSIA

	Genus	Species	Order	Family	Common Name	Parts Affected	Verification Method	Distribution	Status Ahmad Yunus(1980)	Status Upto 2003
1	<i>Ahasverus</i>	<i>advena</i>	Coleoptera	Silvanidae	Foreign grain beetle	seed	C2,L1	PM	P(5)(Ahmad&Ho,1980)	P(11) (DOA 2002)
2	<i>Aspidiotus</i>	<i>destructor</i>	Hemiptera	Diaspididae	Coconut Scale Insect	All parts	C2,L1	PM,Sa,Swk	P(5)(Ahmad&Ho,1980)	P(8) (DOA 2002)
3	<i>Atherigona</i>	<i>orientalis</i>	Diptera	Muscidae	Pepper fruit fly	All parts	C2,L1	PM, Sa	P(5)(Ahmad&Ho,1980)	P(11) (DOA 2002)
4	<i>Cyclonotum</i>	<i>abdominale</i>	Coleoptera	Hydrophilidae	no information	no information	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)
5	<i>Carpophilus</i>	<i>dimidiatus</i>	Coleoptera	Nitidulidae	Corn-Sap Beetle	fruit/ pod, seed	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)
6	<i>Carpophilus</i>	<i>foveicollis</i>	Coleoptera	Nitidulidae	no information	no information	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)
7	<i>Drosophila</i>	<i>ananassae</i>	Diptera	Drosophilidae	no information	no information	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)
8	<i>Diaspis</i>	<i>boisduvalii</i>	Hemiptera	Diaspididae	Boisduval scale	leaf	L1	PM	P(5)(Ahmad&Ho,1980)	P(11) (DOA 2002)
9	<i>Diaspis</i>	<i>bromeliae</i>	Hemiptera	Diaspididae	Pineapple scale	leaf, crown	L1	PM	P(5)(Ahmad&Ho,1980)	P(8) (DOA 2002)
10	<i>Dolicoetranychus</i>	<i>floridanus</i>	Prostigmata	Tenuipalpidae	Pineapple false spider mites	leaf, stem	L1	PM	P(5)(Ahmad&Ho,1980)	P(11) (DOA 2002)
11	<i>Dolicoetranychus</i>	<i>sp</i>	Prostigmata	Tenuipalpidae	similar to <i>D. floridanus</i>	leaf, stem	L1	PM	P(5)(Ahmad&Ho,1980)	P(11) (DOA 2002)
12	<i>Dysmicoccus</i>	<i>brevipes</i>	Hemiptera	Pseudococcidae	Pineapple mealybug	All parts	C2,L1	PM, Sa,Swk	P(5)(Ahmad&Ho,1980)	P(8) (DOA 2002)
13	<i>Gymnonerius</i>	<i>fuscus</i>	Diptera	Micropezidae	no information	no information	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)
14	<i>Glycyphana</i>	<i>sinuate</i>	Coleoptera	Scarabaeidae	no information	no information	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)
15	<i>Haptoncus</i>	<i>luteolus</i>	Coleoptera	Nitidulidae	no information	fruit	L1	PM	P(5)(Ahmad&Ho,1980)	P(11) (DOA 2002)
16	<i>Haptoncus</i>	<i>ocularis</i>	Coleoptera	Nitidulidae	no information	no information	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)
17	<i>Lonchea</i>	<i>aurea</i>	Diptera	Lonchaeidae	no information	no information	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)
18	<i>Locusta</i>	<i>migratoria</i>	Orthoptera	Acridiidae	Asiatic migratory locust	All parts	C2,L1	PM, Sa, Swk	P(5)(Ahmad&Ho,1980)	P(11) (DOA 2002)
19	<i>Lasiodactylus</i>	<i>pictus</i>	Coleoptera	Nitidulidae	no information	no information	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)

	Genus	Species	Order	Family	Common Name	Parts Affected	Verification Method	Distribution	Status Ahmad Yunus(1980)	Status Upto 2003
20	<i>Mimegralla</i>	<i>leucopeza</i>	Diptera	Micropezidae	no information	no information	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)
21	<i>Pinnaspis</i>	<i>minor</i>	Hemiptera	Diaspididae	Small snow scale	no information	L1	PM	P(5)(Ahmad&Ho,1980)	P(11) (DOA 2002)
22	<i>Pseudococcus</i>	<i>sp</i>	Hemiptera	Pseudococcidae	no information	no information	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)
23	<i>Stephanoderes</i>	<i>sp</i>	Coleoptera	Scolytidae	no information	no information	L1	PM	P(5)(Ahmad&Ho,1980)	A(1)
24	<i>Tribolium</i>	<i>castaneum</i>	Coleoptera	Tenebrionidae	Red flour beetle	Fruit	C2,L1	PM	P(5)(Ahmad&Ho,1980)	P(11) (DOA 2002)
25	<i>Valanga</i>	<i>nigricornis</i>	Othoptera	Acridiidae	Valanga grasshopper	leaf	C2,L1	PM, Swk	P(5)(Ahmad&Ho,1980)	P(11) (DOA 2002)

REFERENCE

- 1 Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), *Ministry of Agriculture Bulletin No 153*.
- 2 Department of Agriculture (DOA) Annual Report, (2002)

DISTRIBUTION CODE

PM	Peninsular Malaysia
Swk	Sarawak
Sa	Sabah

VERIFICATION CODE

C1	Collection Centre
C2	Compendium
L1	Literature?journal/Publication
P1	Personel Communication
S1	Survey

STATUS CODE

A(1)	Absent : no pest record
A(2)	Absent : pest no longer present
A(3)	Absent : pest record invalid
A(4)	Absent : pest record unreliable
A(5)	Absent : intercepted only
P(1)	Present : in all parts of the areas
P(2)	Present : only in some areas
P(3)	Present : except in specified pest free areas
P(4)	Present : in all parts of the area where host crop(s) are grown
P(5)	Present : only in some area where host crop(s) are grown
P(6)	Present: only in protect cultivation
P(7)	Present : Seasonally
P(8)	Present : but managed
P(9)	Present : subject to official control
P(10)	Present : under eradication
P(11)	Present : at low prevalence
T(1)	Transience : non-actionable
T(2)	Transience : actionable, under surveillance
T(3)	Transience : actionable, under eradication

***PESTS FACT SHEET OF
PINEAPPLE***

1.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Ahasverus advena</i> (Waltl, 1832)
Common Name	Foreign grain beetle
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Coleoptera
Family	Silvanidae
Synonyms	<i>Cathartus advena</i> Waltl, 1832 <i>Cryptophagus advena</i> Waltl 1834 <i>Silvanus advena</i> Waltl
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Minor on decay and moldy pineapple
Biology & Ecology	<p>1) Life cycle No study had been carryout on pineapple. However, the life cycle takes about 30 days at 30°C and 70% RH on wheat germ. <i>A. advena</i> does not breed when the humidity is below 65% RH (Woodroffe, 1962). However on cocoa it requires at least 80% RH.</p> <p><i>A. advena</i> feeds on damaged foods. It is usually only abundant when they are moldy. Its larvae can feed and develop on dead insects but they do not complete the lifecycle on this diet. <i>A. advena</i> can feed and breed on moulds alone (Hill, 1964), but it frequently occurs in moderate or high numbers on produce that is not conspicuously moldy. Moulds or yeasts provide an important and probably essential nutritional supplement to its diet on many commodities; nevertheless, it can breed successfully on groundnuts or wheat germ, in the absence of mould growth.</p> <p>The adults are strong fliers.</p> <p>2) Affected Plant Stages: Post-harvest.</p> <p>3) Affected Plant Parts: Seeds.</p> <p>4) Symptoms The presence of adults and immature stages on the host are the only symptom shown.</p> <p>5) Damage No information</p>
Host	<p>Primary hosts: stored products (dried stored products) and <i>Theobroma cacao</i> (cocoa).</p> <p>Secondary hosts: <i>Coffea</i> (coffee), <i>Oryza sativa</i> (rice), <i>Zea mays</i> (maize).</p>
Control	<p>No control of this pest on pineapple since it only infests decay and moldy pineapple. However on stored product, the following is been recommended</p> <p>Chemical Control</p> <p>Grain may be protected from infestation by <i>A. advena</i> by the admixture of insecticide such as malathion, fenitrothion and fenvelerate. Grain stocks may be fumigated with phosphine or methyl bromide to eliminate existing infestation, but these treatments provide no protection against re-infestation.</p>

	<p>Cultural Control and Sanitary Methods</p> <p>Good store hygiene plays an important role in limiting infestation by <i>A. advena</i>. The removal of infested residues from the previous season's harvest is essential. Other activities such as ensuring that all spillage of stored crops is removed and that cracks and crevices are filled. Infestations may also be limited by ensuring that the commodity is well dried and free of mould.</p>
<p>References</p>	<ol style="list-style-type: none"> 1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin No 153</i>. 538pp. 2. Hill ST, 1964. Axenic culture of the foreign grain beetle <i>Ahasverus advena</i> (Waltl) (Col., Silvanidae) and the role of fungi in its nutrition. <i>Bulletin of Entomological Research</i>, 55(4):681-690. 3. Woodroffe GE, 1962. The status of the foreign grain beetle, <i>Ahasverus advena</i> (Waltl) (Col., Silvanidae), as a pest of stored products. <i>Bulletin of Entomological Research</i>, 53(3):537-540.

2.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Aspidiotus destructor</i> (Signoret, 1869)
Common Name	Coconut Scale Insect
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Hemiptera
Family	Diaspididae
Synonyms	<i>Aspidiotus cocotis</i> Newstead, 1893 <i>Aspidiotus lataniae</i> Green, 1896 <i>Aspidiotus simillimus</i> translucens Fernald <i>Aspidiotus translucens</i> Cockerell & Robinson, 1915 <i>Aspidiotus transparens</i> Green 1890 <i>Aspidiotus vastatrix</i> Leroy <i>Temnaspidotus destructor</i> (Signoret)
Distribution	Malaysia: (Waterhouse, 1993); Peninsular Malaysia: (CIE, 1966; Ahmad & Ho, 1980); Sabah: (CIE, 1966); Sarawak (CIE, 1966)
Status	Minor
Biology & Ecology	<p>1) Life cycle The life cycle of <i>A. destructor</i> typically lasts for 32-34 days. Tabibullah and Gabriel (1973) found that the life cycle of females were 32 days and males 27 days respectively. The larvae and the adult males are the only mobile stages during the life cycle.</p> <p>The eggs of <i>A. destructor</i> are laid under the scale of the adult female. The female deposits 20-50 eggs under her scale over a few days. The eggs are incubated for 7-8 days. In the Philippines, on coconuts, the egg stage lasted for 8 days in both sexes (Tabibullah and Gabriel, 1973). After hatching, the nymphs crawl under the scale edge out into the open and colonize the undersurface of the leaf.</p> <p>The females have two nymphal stages. The males have four immature stages: two feeding nymphal stages, a pre-pupal and a pupal stage (Tabibullah and Gabriel, 1973).</p> <p>The first-instar larva (crawler) leaves the maternal scale and begins feeding on the leaves of the host. It is mobile in both sexes. Crawlers are found on the undersides of leaves and tender shoots and on leaf tips. They easily drop off from the leaves and may be dispersed by the wind. Damage is reduced during the rainy season.</p> <p>The average number of eggs laid by one female in each generation was 32-42. At room temperature (26-28°C), the egg stage lasted for 5 days, the larval stage lasted 17 days, the pre-oviposition stage in adult females lasted 25 days, the female generation lasted 44 days and the male generation lasted 38 days (Zhou et al., 1993). The first generation of eggs hatched from late April to early May, and the second and third generations hatched in July and September, respectively (Tang and Qin, 1991).</p> <p>2) Affected Plant Stages: Flowering stage, fruiting stage, seedling stage, and vegetative growing stage.</p> <p>3) Affected Plant Parts: Leaves, stems, growing points, and fruits/pods.</p> <p>4) Symptoms On leaves, <i>A. destructor</i> causes scale, and yellow spots develop where the larvae and adults settle. Entire leaves may turn yellow to brown and fall.</p> <p>5) Damage No information</p>

Host	<p>Primary hosts: <i>Cocos nucifera</i> (coconut), <i>Musa</i> (banana), <i>Elaeis guineensis</i> (oil palm), <i>Mangifera indica</i> (mango).</p> <p>Secondary hosts: Brassica, <i>Camellia sinensis</i> (tea), <i>Carica papaya</i> (papaya), Citrus, Cucumis (Cucumber), <i>Dioscorea</i> (yam), <i>Hevea brasiliensis</i> (rubber), <i>Lycopersicon esculentum</i> (tomato), <i>Myristica fragrans</i> (nutmeg), Pandanus, <i>Persea americana</i> (avocado), Piper (pepper), <i>Piper nigrum</i> (black pepper), <i>Prunus persica</i> (peach), <i>Psidium guajava</i> (common guava), Rhizophora, <i>Saccharum officinarum</i> (sugarcane), <i>Theobroma cacao</i> (cocoa), <i>Tamarindus indica</i> (Indian tamarind), <i>Zingiber officinale</i> (ginger).</p>
Control	<p>Chemical Control Cypermethrin and Malathion have been used successfully to control this pest on pineapple.</p> <p>Cultural Control During the early stages of an outbreak, the leaves are cut and burn the affected part.</p>
References	<ol style="list-style-type: none"> 1. Ahmad, Y and Ho, T.H. (1980) List of economic pests, host plants, parasites and predators in west Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i>. 538pp 2. CIE (1966). Distribution Maps of Plant Pests, No. 218. Wallingford, UK: <i>CAB International</i>. 3. Tabibullah M,& Gabriel, B.F. (1973). Biological study of <i>Aspidiotus destructor</i> Signoret in different coconut varieties and other host plants. <i>Philippine Entomologist</i>, 2(6):409-426. 4. Tang S.J. & Qin H.Z. (1991). Study on <i>Temnaspidotus destructor</i> (Signoret). <i>Journal of Shanghai Agricultural College</i>, 9(3):190-196. 5. Zhou C.A., Zou, J.J, & Peng, J.C. (1993). Bionomics of coconut scale - a main pest insect on Actinidia and its control. <i>Entomological Knowledge</i>, 30(1):18-20.

3.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Atherigona orientalis</i> Schiner
Common Name	Pepper fruit fly
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Diptera
Family	Muscidae
Synonyms	Acritochaeta excisa Acritochaeta orientalis (Schiner) Acritochaeta pulvinata Grimshaw Atherigona excisa var. flavipennis Malloch Atherigona magnipalpis Stein Atherigona trilineata Stein Coenosia excisa Thomson 1869
Distribution	Peninsular Malaysia: (Ahmad & Ho 1980; Pont, 1992); Sabah:(Pont, 1992)
Status	Non pest (feed on damage pineapple fruits)
Biology & Ecology	<p>1)Life cycle Under laboratory conditions at a mean temperature of 28°C and 63% RH, the egg stage, first-, second- and third-instar larva, and pupariation took 1, 0.5-1, 1-2, 9-11 and 12-15 days, respectively (Couri and Aroujo, 1992). In Pakistan, six to seven generations were passed during the crop season and the average incubation, larval and puparial periods ranged from 36 to 48 hours, 7 to 8 days and 5 to 6 days, respectively; 15-19 eggs being laid under the skin of each Capsicum fruit (Chughtai et al., 1985). According to Iheagwam and Nwankiti (1980) the larvae penetrated Capsicum fruits of all ages and fed on the ovules, seeds, placenta and mesocarp and made them susceptible to secondary infection by rot-producing microorganisms. However, most observations suggest that the microorganisms are likely to have been present first, at least in most cases.</p> <p>2) Affected Plant Stages: Pre-emergence, seedling stage, vegetative growing stage, flowering stage, fruiting stage, and post-harvest.</p> <p>3) Affected Plant Parts: Whole plant, leaves, stems, roots, growing points, fruits/pods, and vegetative organs. Secondary hosts</p> <p>4) Symptoms <i>A. orientalis</i> is normally associated with plant rot cause by physical damage.</p> <p>5) Damage No information</p>
Host	<p>Primary hosts: <i>Lycopersicon esculentum</i> (tomato), <i>Brassica oleracea</i> (cabbages, cauliflowers), <i>Capsicum annuum</i> (bell pepper), <i>Cucumis melo</i> (melon), Phaseolus (beans).</p> <p>Secondary hosts: <i>Allium cepa</i> (onion), <i>Cocos nucifera</i> (coconut), <i>Carica papaya</i> (papaw), <i>Capsicum frutescens</i> (chilli), <i>Cucumis sativus</i> (cucumber), <i>Daucus carota</i> (carrot), <i>Manihot esculenta</i> (cassava), <i>Mangifera indica</i> (mango), <i>Oryza sativa</i> (rice), <i>Zingiber officinale</i> (ginger), <i>Helianthus annuus</i> (sunflower), <i>Zea mays</i> (maize).</p> <p>Associated with: <i>Ananas comosus</i> (pineapple), <i>Elaeis guineensis</i> (African oil palm), <i>Nicotiana tabacum</i> (tobacco), <i>Saccharum officinarum</i> (sugarcane).</p>
Control	<p>Chemical Control No chemical control is recommended to control this pest on pineapple</p>

<p>References</p>	<ol style="list-style-type: none"> 1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in west Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i>. 538pp 2. Chughtai G.H.; Khan S. & Baloch U.K. (1985). A new record of infestation of melon fruits by an anthomyiid fly in Indus River Beach areas of D.I. Khan. <i>Pakistan Journal of Zoology</i>, 17(2):165-168. 3. Couri M.S. & Araujo P.F. (1992). The immature stages of <i>Atherigona orientalis</i> Schiner (Diptera: Muscidae). <i>Proceedings of the Biological Society of Washington</i>, 105(3):490-493. 4. Iheagwam E.U. & Nwankiti O.C. (1980). Dipterous insect pests of pepper, <i>Capsicum</i> spp., in the eastern states of Nigeria. <i>Revue de Zoologie Africaine</i>, 94(4):936-939. 5. Pont A.C. (1992) The world distribution, host range and abundance of <i>Atherigona orientalis</i> Schiner, 1968 (Insecta, Diptera, Muscidae), <i>Bureau of Rural Resources, Department of Primary Industries and Energy</i>, No. IP/1/92:21-65.
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4.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Cyclonotum abdominale</i>
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Coleoptera
Family	Hydrophilidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Non pest
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	<p>Primary hosts: No information</p> <p>Secondary hosts No information</p>
Control	No control has been recommended
References	<p>1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i>. 538pp.</p>

5.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Carpophilus dimidiatus</i>
Common Name	Corn-Sap Beetle
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Coleoptera
Family	Nitidulidae
Synonyms	Nitidula dimidiata
Distribution	Malaysia: (Aitken, 1975) Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Minor
Biology & Ecology	<p>1) Life cycle No life cycle had been study on pineapple. However, on other commodities such dates varied from 49 days at 18.5°C to 15 days at 32°C. Development of this species was slower on wheat bran with the shortest development period of 26 days at 32.5°C and 90% RH. The best survival rate was achieved between 22.5 and 27°C at 70% RH.</p> <p>2) Affected Plant Stages: Fruiting stage and post-harvest.</p> <p>3) Affected Plant Parts: Fruits/pods and seeds</p> <p>4) Symptoms Adults and larvae may be found moving across the surface of infested commodities</p> <p>5) Damage No information</p>
Host	Primary hosts: <i>Arachis hypogaea</i> (groundnut), <i>Myristica fragrans</i> (nutmeg), <i>Oryza sativa</i> (rice), stored products (dried stored products), <i>Zea mays</i> (maize) and <i>Theobroma cacao</i> (cocoa).
Control	No control has been recommended for pineapple
References	1. Ahmad, Y. & Ho, T. H. (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), Ministry of Agriculture Bulletin No. 153, 538 pp

6.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Carpophilus foveicollis</i>
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Coleoptera
Family	Nitidulidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	-
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	No control required
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp

7.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Drosophila ananassae</i>
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Diptera
Family	Drosophilidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Minor
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	No control measures had been recommended
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp

8.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Diaspis boisduvalii</i> Signoret 1869
Common Name	Boisduval scale, Pineapple scale
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Hemiptera
Family	Diaspididae
Synonyms	<i>Aulacaspis boisduvalii</i> Signoret
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Minor
Biology & Ecology	<p>1) Life cycle The life cycle of this species is about 30 days from egg to adult. The nymphal stages have legs and move from branches to another.</p> <p>2) Affected Plant Stages: All stages</p> <p>3) Affected Plant Parts: leaves</p> <p>4) Symptoms The nymph and adult feed on plant juices through the sucking mouthparts. Amours are place on bark of branches as main symptom of infestation.</p> <p>5) Damage No information</p>
Host	Primary hosts: <i>Ananas comosus</i> (pineapple), <i>Cocos nucifera</i> (coconut), Musa (banana) and orchids (cattleya, dendrobium, oncidium and vanda)
Control	<p>Chemical Control White oil is recommended to control infested plants.</p> <p>Cultural control Used clean sucker during planting. Adequate plant spacing is important because armored scales seldom move from plant to plant except when crowns of the plants are in contact.</p>
References	1. Ahmad, Y. and Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> , 538pp

9.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Dysmicoccus brevipes</i> (Cockerell, 1893)
Common Name	Pineapple mealybug
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Hemiptera
Family	Pseudococcidae
Synonyms	<p><i>Dactylopius</i> (Pseudococcud) <i>ananassae</i> Kuwana <i>Dactylopius brevipes</i> Cockerell, 1893 <i>Dactylopius bromeliae</i> <i>Dysmicoccus bromeliae</i> Auct. <i>Dysmicoccus cannae</i> <i>Dysmicoccus pseudobrevipes</i> (Mamet 1941) <i>Pseudococcus brevipes</i> (Cockerell), Fernald, 1903 <i>Pseudococcus bromeliae</i> <i>Pseudococcus cannae</i> Green, 1934 <i>Pseudococcus longirostralis</i> James, 1936 <i>Pseudococcus missionum</i> Cockerell, 1910 <i>Pseudococcus palauensis</i> Kanda, 1933 <i>Pseudococcus pseudobrevipes</i> Mamet, 1941</p>
Distribution	Malaysia: (Waterhouse, 1993; Ben-Dov, 1994); Peninsular Malaysia: (CIE, 1972, Ahmad & Ho, 1980); Sabah: (CIE, 1972); Sarawak: (CIE, 1972)
Status	Major
Biology & Ecology	<p>1) Life cycle The biology of the biparental form of <i>D. brevipes</i> has been studied in West Malaysia by Lim (1973), where it was becoming increasingly important as a pest of pineapple. The females had three nymphal instars, lasting 10.0, 6.7 and 7.9 days, respectively. The males had two nymphal instars, a prepupal and pupal stage, lasting 9.9, 5.8, 2.5 and 3.7 days, respectively. Development from first instar to adult took about 24 days in both sexes. The adult females lived for 17-49 days, whereas the adult males lived for 1-3 days. When gravid, ovoviviparous females could give rise to 19-137 first instars, over a period of 9.1 days, beginning 14.6 days after adulthood was reached. The sex ratio was 1:1. The life-cycle of the biparental form of <i>D. brevipes</i> was shorter than that of the parthenogenetic form in Hawaii.</p> <p>The main dispersal stage of <i>D. brevipes</i> is the first instar that moves about actively for a short period, probably for no more than a day. The first instars may be dispersed by wind and animals. All life stages may be dispersed over longer distances in trade on consignments of plant material and fruit.</p> <p>The parthenogenetic form of <i>D. brevipes</i> is largely confined to the lower portions of the pineapple plant, near ground level or below, whereas the biparental form of <i>D. brevipes</i>, together with <i>D. neobrevipes</i>, occur primarily on the crown and developing fruit.</p> <p>2) Affected Plant Stages: Flowering stage, fruiting stage, post-harvest, and vegetative growing stage.</p> <p>3) Affected Plant Parts: Whole plant, leaves, stems, roots, growing points, and fruits/pods.</p> <p>4) Symptoms <i>D. brevipes</i> is common on the roots of pineapple and large colonies develop on the stems just above ground level. The mealybugs may spread upwards to feed in the floral cavities, on both small and mature fruit, and on the crown leaves. The symptoms of the wilt disease are preliminary reddening of leaves followed by a definite colour change from red to pink and an inward refluxing of the leaf margins; a general debility, loss of</p>

	<p>rigidity and wilted appearance, and finally a recovery state in which the plant grows fresh, apparently normal leaves (Rohrbach et al., 1988). Occasionally this wilting process can be very rapid. The severity of the wilt symptoms depends on the size of the mealybug population. Wilted plants have reduced weight, leaf surface area, number of leaves, leaf length and breadth and root length.</p> <p>Feeding in the blossom cavities causes wounds that sometimes become contaminated by fungal spores resulting in a disorder called black spot. The biparental form of <i>D. brevipes</i> (and <i>D. neobrevipes</i>) can also cause local green or chlorotic spotting of the foliage.</p> <p>5) Damage <i>D. brevipes</i> is a cosmopolitan pest of pineapple and a vector of pineapple wilt disease.</p>
Host	<p><i>D. brevipes</i> is highly polyphagous, attacking plant species belonging to more than a 100 genera placed in 53 families (Ben-Dov, 1994).</p> <p>Primary hosts: <i>Ananas comosus</i> (pineapple), Poaceae (cereals), Palmae (plants of the palm family), <i>Arachis hypogaea</i> (groundnut), <i>Brassica rapa</i> subsp. <i>chinensis</i> (Chinese cabbage), <i>Cocos nucifera</i> (coconut), <i>Coffea arabica</i> (arabica coffee), Capsicum (peppers), <i>Cucumis sativus</i> (cucumber), <i>Daucus carota</i> (carrot), <i>Elaeis guineensis</i> (African oil palm), Ficus, <i>Ipomoea batatas</i> (sweet potato), <i>Manihot esculenta</i> (cassava), <i>Mangifera indica</i> (mango), Musa (banana), <i>Psidium guajava</i> (common guava), <i>Saccharum officinarum</i> (sugarcane), <i>Solanum tuberosum</i> (potato), <i>Theobroma cacao</i> (cocoa), <i>Zea mays</i> (maize), <i>Zingiber officinale</i> (ginger).</p>
Control	<p>Cultural control Crowns and slips used for new planting are selected from plant free from the mealbug. Dipped these crown and slip in hot water at the temperature of 50 C</p> <p>Chemical Control <i>D. brevipes</i> was effectively controlled on pineapple in using fenitrothion, malathion, diazinon or white oil</p>
References	<ol style="list-style-type: none"> 1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i>. 538pp 2. Ben-Dov Y. (1994). A systematic catalogue of the mealybugs of the world (Insecta: Homoptera: Coccoidea: Pseudococcidae and Putoidae) with data on geographical distribution, host plants, biology and economic importance. <i>Andover, UK; Intercept Limited</i>, 686 pp. 3. CIE, (1972) Distribution Maps of Pests, Series A No. 50 (revised). Wallingford, UK: <i>CAB International</i>. 4. CIE (1972) Distribution Maps of Plant Pests, No. 50. Wallingford, UK: <i>CAB International</i>. 5. Lim W.H. (1973). Studies on the bisexual race of <i>Dysmicoccus brevipes</i> Ckll.: its bionomics and economic importance. <i>Malaysian Agricultural Journal</i>, 49(2):254-267. 6. Rohrbach K.G.; Beardsley, J.W.; German T.L. Reimer N.J. & Sanford W.G. (1988) Mealybug wilt, mealybugs, and ants of pineapple. <i>Plant Disease</i>, 72(7):558-565; 30 ref. 7. Waterhouse D.F. (1993). The major arthropod pests and weeds of agriculture in Southeast Asia. The major arthropod pests and weeds of agriculture in Southeast Asia., v 141 pp.; [<i>ACIAR Monograph No. 21</i>]; 3 pp.

10.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Diaspis bromeliae</i> (Kerner 1778)
Common Name	Pineapple scale
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Hemiptera
Family	Diaspididae
Synonyms	Coccus bromeliae Kerner 1778
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Minor
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: Vegetative, flowering and fruiting stages</p> <p>3) Affected Plant Parts: leaves/crowns</p> <p>4) Symptoms The insect starts feeding on the base of the leaves, fruit and peduncle. Leaves become chlorotic.</p> <p>5) Damage No information</p>
Host	Primary hosts: <i>Ananas comosus</i> (pineapple)
Control	Chemical Control Spray with malathion or white oil.
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp

11.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Dolicoetranychus floridanus</i> (Banks)
Common Name	Pineapple false spider mites
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Acarina
Order	Prostigmata
Family	Tenuipalpidae
Synonyms	Stigmaeus floridanus
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Minor
Biology & Ecology	<p>1) Life cycle No life cycle had been study</p> <p>2) Affected Plant Stages: Vegetative, flowering and fruiting</p> <p>3) Affected Plant Parts: leaves and stem</p> <p>4) Symptoms Leaves have small spot of bronzing.</p> <p>5) Damage No information</p>
Host	Primary hosts: <i>Ananas comosus</i> (pineapple)
Control	Chemical Control Spraying of miticide such as Omite
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp.

12.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Dolicotetranychus</i> sp
Common Name	Suspected to be similar to <i>D. floridanus</i>
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Acarina
Order	Prostigmata
Family	Tenuipalpidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	minor
Biology & Ecology	<p>1) Life cycle There is no study on the life cycle</p> <p>2) Affected Plant Stages: Vegetative, flowering and fruiting</p> <p>3) Affected Plant Parts: Leaves</p> <p>4) Symptoms Leaves have small spot of bronzing</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	No control have been recommended
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp

13.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Gymnonerius fuscus</i>
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Diptera
Family	Micropezidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Non pest of pineapple
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	Chemical Control No information
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp.

14.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Glycyphana sinuate</i>
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Coleoptera
Family	Scarabaeidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Non pest
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	Chemical Control No information
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp.

15.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Haptoncus luteolus</i> (Erichson)
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Coleoptera
Family	Nitidulidae
Synonyms	<i>Epuraea luteola</i> Er.
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: Fruit stage</p> <p>3) Affected Plant Parts: Fruit</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: Annona, Ficus carica (common fig)
Control	Chemical Control No chemical control had been recommended
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp.

16.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Haptoncus ocularis</i>
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Coleoptera
Family	Nitidulidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Non pest
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	Chemical Control No chemical control had been recommended
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp.

17.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Lonchea aurea</i>
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Diptera
Family	Lonchaeidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Non pest
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	Chemical Control No control measure had been recommended
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp.

18.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Locusta migratoria</i> (Linnaeus, 1758)
Common Name	Asiatic migratory locust
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Orthoptera
Family	Acridiidae
Synonyms	<p><i>Acridium migratorium</i> Brullé, 1840 <i>Acrydium manilensis</i> Meyen, 1835 <i>Gastrimargus affinis</i> Sjöstedt, 1931 <i>Gastrimargus morio</i> Sjöstedt, 1931 <i>Gryllus (Locusta) danicus</i> Linnaeus, 1767 <i>Gryllus (Locusta) migratorius</i> Linnaeus, 1758 <i>Gryllus cinerascens</i> Fabricius, 1781 <i>Locusta capito</i> Kirby, 1910 <i>Locusta christii</i> Denny, 1842 <i>Locusta danica</i> Kirby, 1902 <i>Locusta migratoria burmana</i> Ramme, 1951 <i>Locusta migratoria capito</i> (Saussure 1884) <i>Locusta migratoria capito</i> Zolotarevsky, 1929 <i>Locusta migratoria gallica</i> Remaudière, 1947 <i>Locusta migratoria manilensis</i> (Meyen 1835) <i>Locusta migratoria migratorioides</i> (Reiche & Fairmaire 1850) <i>Locusta migratoria migratorioides</i> Uvarov, 1928 <i>Locusta migratoria rossica</i> Uvarov & Zolotarevsky, 1929 <i>Locusta migratoria tibetensis</i> Chen, 1963 <i>Locusta migratorioides</i> Kirby, 1902 <i>Oedipoda migratoria</i> Audinet-Serville, 1831 <i>Oedipoda migratorioides</i> Reiche & Fairmaire, 1850 <i>Pachytylus australis</i> Saussure, 1884 <i>Pachytylus capito</i> Saussure, 1884 <i>Pachytylus cinerascens</i> Fieber, 1853 <i>Pachytylus danicus</i> Bolívar, 1895 <i>Pachytylus migratoria</i> capito <i>Pachytylus migratoria migratorioides</i> <i>Pachytylus migratorioides</i> var. <i>capito</i> Saussure, 1884 <i>Pachytylus migratorius</i> Walker, 1870</p>
Distribution	Malaysia: (APPPC, 1987); Peninsular Malaysia: (Corbett & Miller, 1936; Uvarov, 1936; Ahmad & Ho, 1980; Steedman, 1990); Sabah: (Uvarov, 1936; Steedman, 1990); Sarawak: (Uvarov, 1936; Fao, 1977).
Status	Non-pest
Biology & Ecology	<p>1) Life Cycle <i>L. migratoria</i> typically undergoes four to five generations per year in the tropics of South-East Asia; this contrasts with three in the subtropics . There are no drought-resistant stages and each generation requires moist conditions for successful reproduction. <i>L. migratoria</i> is therefore confined to areas where there are sequences of temporarily favorable breeding habitats provided by either seasonal rainfall patterns or by combinations of rainfall and flood regimes. The timing of the generations is closely attuned to the timing of seasonal rains and flood regimes. The seasonal breeding areas are usually connected by complex migratory movements, which are often, but not always, related to seasonal shifts in prevailing winds (Farrow, 1974a).</p> <p>2) Affected Plant Stages: Seedling stage, vegetative growing stage, flowering stage, and fruiting stage.</p>

	<p>3) Affected Plant Parts: Whole plant, leaves, stems, growing points, inflorescence, fruits/pods, and seeds.</p> <p>4) Symptoms Symptoms are not very specific and they depend on the type of plant attacked and the degree of hunger of the pest. The leaves are usually the first plant parts to be attacked and these can be chewed almost completely or if they are rather hard, the major veins, especially the midribs, are left. In cereals, varying proportions of the ripening grains are chewed back. Seed pods and fruits may also be attacked. When hungry, the locusts may chew stems and bark.</p> <p>5) Damage Damage to crops only occurs in the gregarious phase. When attacked in the vegetative stage, they may still recover and produce grain, though the yield may be less. The estimate losses is difficult since no outbreak had happen in this country.</p>
Host	<p><i>L. migratoria</i> is primarily a grass feeder. Solitary individuals mostly feed on the vegetative parts of the plant and are of no economic importance.</p> <p>Primary hosts: <i>Oryza sativa</i> (rice), <i>Saccharum officinarum</i> (sugarcane), <i>Zea mays</i> (maize).</p> <p>Secondary hosts: <i>Ipomoea batatas</i> (sweet potato), <i>Manihot esculenta</i> (cassava), <i>Musa</i> (banana), <i>Musa paradisiaca</i> (plantain), <i>Phaseolus</i> (beans).</p> <p>Wild hosts: Poaceae (cereals).</p>
Control	No control measure had been recommended
References	<ol style="list-style-type: none"> 1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i>. 538pp. 2. Corbett G.H. & Miller N.C.E. (1936). The Oriental Migratory Locust (<i>Locusta migratoria manilensis</i> Meyen) and the Bombay Locust (<i>Patanga succincta</i> L.) in Malaya. <i>Scient. Ser. Dep. Agric. Straits Settl. & F.M.S. Bull.</i> (18):15. 3. FAO (1977) New records. Quarterly Newsletter, <i>FAO Plant Protection Commission for the South East Asia and Pacific Region</i> 20: 8-11. 4. Farrow R.A. (1974) A modified light-trap for obtaining large samples of night-flying locusts and grasshoppers. <i>Journal of the Australian Entomological Society</i>, 13(4):357-360. 5. Uvarov B.P. (1936) The Oriental migratory locust (<i>Locusta migratoria manilensis</i>) Meyen 1835. <i>Bulletin of Entomological Research</i>, 27:91-104.

19.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Lasiodactylus pictus</i>
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Coleoptera
Family	Nitidulidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	Chemical Control No control measures had been recommended
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp

20.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Mimegralla leucopeza</i>
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Diptera
Family	Micropezidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Non pest
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	No control measures had been recommended
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp

21.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Pinnaspis minor</i>
Common Name	Small snow scale
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Hemiptera
Family	Diaspididae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	No information
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	No control measures had been recommended
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp

22.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Pseudococcus</i> sp.
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Hemiptera
Family	Pseudococcidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Unkown (no specimen available to verify)
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	Chemical Control No control measure had been recommended
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp

23.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Stephanoderes</i> sp
Common Name	-
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Coleoptera
Family	Scolytidae
Synonyms	-
Distribution	Peninsular Malaysia (Ahmad & Ho, 1980)
Status	Non pest
Biology & Ecology	<p>1) Life cycle No information</p> <p>2) Affected Plant Stages: No information</p> <p>3) Affected Plant Parts: No information</p> <p>4) Symptoms No information</p> <p>5) Damage No information</p>
Host	Primary hosts: No information
Control	No control measure had been recommended
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> . 538pp

24.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Tribolium castaneum</i> Herbst
Common Name	Red flour beetle
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Coleoptera
Family	Tenebrionidae
Synonyms	<i>Colydium castaneum</i> Herbst <i>Tribolium navale</i> auct.
Distribution	Peninsular Malaysia (Ahmad Yunus & Ho, 1980); (Yunus & Balasubramaniam, 1981)
Status	Minor (found on decay pineapple)
Biology & Ecology	<p>1) Life Cycle No information on the life cycle on pineapple. On stored grain. The adult females of <i>T. castaneum</i> lay up to 450 eggs in stored products. The incubation period of the eggs is between 5 and 12 days. A fully-grown larva is 6 mm long and takes 27-29 days. Pupation occurs in the host and adults emerge from the pupa in 3-7 days. The adults may live for as long as 18 months, depending on weather conditions.</p> <p>2) Affected Plant Stages: Post-harvest.</p> <p>3) Affected Plant Parts: Fruits/pods, and vegetative organs.</p> <p>4) Symptoms Newly emerged larvae are able to develop on visibly undamaged grains (Roorda et al., 1982) and the larvae prefer the germs of grains for feeding.</p> <p>Infestation by adult beetles can be readily observed by the tunnels they leave when they move through the flour and other granular food products. Damage is particularly serious in grains such as rice and wheat, which have either been dehusked or processed into other products. When infestation is severe, these products turn greyish-yellow and become mouldy, with a pungent odour.</p> <p>5) Damage Both the larvae and adults of <i>T. castaneum</i> damage the host. They cause extensive damage to grains already damaged during handling at harvest, whole grains, and those damaged by other pests.</p> <p>A single <i>T. castaneum</i> larva was shown to cause a mean dry weight loss of 12.3 mg, in laboratory tests on millet, at 28°C and 10% RH (Roorda et al., 1982); at 70% RH, the loss was 7.9 mg.</p>
Host	<p>Primary hosts: <i>Arachis hypogaea</i> (groundnut), <i>Oryza sativa</i> (rice), Phaseolus (beans), stored products (dried stored products), <i>Zea mays</i> (maize).</p> <p>Secondary hosts: Brassica Capsicum (peppers), <i>Capsicum annum</i> (bell pepper), <i>Hevea brasiliensis</i> (rubber), <i>Ipomoea batatas</i> (sweet potato), <i>Manihot esculenta</i> (cassava), <i>Myristica fragrans</i> (nutmeg), <i>Nicotiana tabacum</i> (tobacco), <i>Phaseolus vulgaris</i> (common bean), <i>Theobroma cacao</i> (cocoa), <i>Zingiber officinale</i> (ginger).</p>
Control	No control had been recommended
References	1. Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i> .

	<p>538pp.</p> <ol style="list-style-type: none"><li data-bbox="411 255 1437 376">2. Roorda F.A.; Schulten G.G.M. & Andriessen EAM, (1982). Laboratory observations on the development of <i>Tribolium castaneum</i> Herbst (Col., Tenebrionidae) on millet at different temperatures and relative humidities. <i>Zeitschrift fur Angewandte Entomologie</i>, 93(5):446-452.<li data-bbox="411 409 1437 470">3. Yunus A, & Balasubramaniam A, (1981). Major crop pests in Peninsular Malaysia. Kuala Lumpur, Malaysia: <i>Ministry of Agriculture Malaysia</i>.
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25.0 PEST FACT SHEET (PINEAPPLE)

Name	<i>Valanga nigricornis</i> (Burmeister)
Common Name	Valanga grasshopper
Domain	Eukaryota
Kingdom	Metazoa
Phylum	Arthropoda
Class	Insecta
Order	Othoptera
Family	Acridiidae
Synonyms	<i>Acridium melanocorne</i> <i>Acridium nigricorne</i> <i>Cyrtacanthacris melanocornis</i> <i>Cyrtacanthacris nigricornis</i> <i>Orthocanthacris nigricornis</i> <i>Valanga melanocornis</i>
Distribution	Malaysia: (Waterhouse, 1993): Peninsular Malaysia (Ahmad & Ho, 1980): Sarawak: (CAB ABSTRACTS, 1989)
Status	No feeding on pineapple was observed
Biology & Ecology	<p>1) Life cycle The life cycle takes about 5 month with 6 nymgal instar of 80 days. The egg stage may takeas as long as 2 months.</p> <p>2) Affected Plant Stages: All stages</p> <p>3) Affected Plant Parts: leaves</p> <p>4) Symptoms This Phytophagous insect feed on leaves of its host.</p> <p>5) Damage No information</p>
Host	Primary hosts: <i>Saccharum officinarum</i> (sugarcane), <i>Zea mays</i> (maize).
Control	No control is recommended for pineapple
References	<ol style="list-style-type: none"> Ahmad, Y & Ho, T.H (1980) List of economic pests, host plants, parasites and predators in West Malaysia (1920-1978), <i>Ministry of Agriculture Bulletin no 153</i>. 538pp Waterhouse D.F. (1993). The major arthropod pests and weeds of agriculture in Southeast Asia, ACIAR Monograph No. 21(V): 141 pp

***DISEASES LIST
OF
PINEAPPLE***

DISEASES LIST OF PINEAPPLE IN MALAYSIA

	Genus	Species	Order	Family	Common name	Parts Affected	Distribution	Verification Method(Ref.2)	Status K.G.Singh(1980)	Status upto 2003
1	<i>Antennularis</i>	<i>sp.</i>	No information	No information	No information	Leaf	PM	L1	A(5)(K.G.Singh,1980)	A(1)No pest records
2	<i>Asterinella</i>	<i>stuhmannii</i>	Microthyriales	Microthyriaceae	Leaf spot	Leaf	PM, Sa	C2, L1	A(5)(K.G.Singh,1980)	A(1)No pest records
3	<i>Beltrania</i>	<i>indica</i>	No information	No information	Leaf spot	No information	PM	L1	A(3)(K.G.Singh,1980)	A(1)No pest records
4	<i>Botryodiplodia</i>	<i>theobromae</i>	Xylariales	Hyponectriaceae	Leaf blight	Leaves	Swk	C2, L1	P(5)(K.G.Singh,1980)	P(5)(Lim WH,1985)
5	<i>Capnodium</i>	<i>sp.</i>	Capnodiales	Capnodiaceae	Sooty mould	No information	PM	C2, L1	P(5)(K.G.Singh,1980)	A(1)No pest records
6	<i>Ceratocystis</i>	<i>paradoxa</i>	Microascales	Ceratocystidaceae	Thielaviopsis soft rot	Leaves, stems/base and fruits	PM	C2, L1	P(5)(K.G.Singh,1980)	P(5)(Lim WH,1985)
7	<i>Clonostachus</i>	<i>sp.</i>	No information	No information	No information	Leaves	PM	L1	A(5)(K.G.Singh,1980)	A(1)No pest records
8	<i>Cochliobolus</i>	<i>geniculatus</i>	Pleosporales	Pleosporaceae	No information	Leaves	Sa	C2, L1	A(5)(K.G.Singh,1980)	A(1)No pest records
9	<i>Colletotrichum</i>	<i>capsici</i>	No information	No information	Leaf tip dieback	Leaves	PM	L1	P(5)(K.G.Singh,1980)	A(1)No pest records
10	<i>Colletotrichum</i>	<i>sp.</i>	No information	No information	Anthracnose	Leaves	PM	C2, L1	A(1)(K.G.Singh,1980)	P(5)(Lim WH,1985)
11	<i>Curvularia</i>	<i>eragrostidis</i>	Pleosporales	Pleosporaceae	Leaf rot, leaf blight	Leaves	Swk	C2, L1	P(5)(K.G.Singh,1980)	P(5)(Lim WH,1985)
12	<i>Curvularia</i>	<i>lunata</i>	No information	No information	Leaf spot	No information	PM	L1	P(5)(K.G.Singh,1980)	A(1)No pest records
13	<i>Curvularia</i>	<i>maculans</i>	No information	No information	Leaf spot	Leaves	PM	L1	P(5)(K.G.Singh,1980)	A(1)No pest records
14	<i>Erwinia</i>	<i>ananas</i>	Enterobacteriales	Enterobacteriaceae	Bacterial fruitlet rot	Fruits/pods	PM	C2, L1	P(5)(K.G.Singh,1980)	P(5)(Lim WH,1985)
15	<i>Erwinia</i>	<i>chrysanthemii</i>	Enterobacteriales	Enterobacteriaceae	Bacterial heart rot	Heart, leaves and fruits/pods	PM	C2, L1	P(5)(K.G.Singh,1980)	P(5)(Lim WH,1985)
16	<i>Fusarium</i>	<i>moniliforme</i>	Hypocreales	Nectriaceae	Fruitlet core rot	Fruit	PM	C2, L1	P(5)(K.G.Singh,1980)	P(5)(Lim WH,1985)
17	<i>Gliomastix</i>	<i>luzulae</i>	No information	No information	No information	No information	Sa	L1	A(5)(K.G.Singh,1980)	A(1)No pest records

	Genus	Species	Order	Family	Common	Parts	Distribution	Verification	Status	Status
					name	Affected		Method(Ref.2)	K.G.Singh(1980)	upto 2003
18	<i>Hendersonula</i>	<i>toruloidea</i>	No information	No information	fruit rot, leaf spot	Fruit and leaves	PM	C2, L1	P(5)(K.G.Singh,1980)	P(5)(Lim WH,1985)
19	<i>Macrophomina</i>	<i>phaseoli</i>	No information	No information	No information	Leaves	PM	L1	A(5)(K.G.Singh,1980)	A(1)No pest records
20	<i>Marasmiellus</i>	<i>scandens</i>	Agaricales	Marasmiaceae	Thread blight,	No information	Swk	C2, L1	P(5)(K.G.Singh,1980)	A(1)No pest records
21	<i>Marasmius</i>	<i>crinis-equi</i>	Agaricales	Marasmiaceae	Horse hair blight	Leaves	Swk	C2, L1	P(5)(K.G.Singh,1980)	A(1)No pest records
22	<i>Marasmius</i>	<i>palmivorus</i>	Agaricales	Marasmiaceae	Chlorosis, fruitlet brown rot	Fruit	PM	C2, L1	P(5)(K.G.Singh,1980)	A(1)No pest records
23	<i>Paecilomyces</i>	<i>elegans</i>	No information	No information	Basal leaf rot	Leaves	PM	L1	P(5)(K.G.Singh,1980)	A(1)No pest records
24	<i>Phomopsis</i>	<i>sp.</i>	No information	No information	No information	Leaves	Sa, Swk	C2, L1	A(5)(K.G.Singh,1980)	A(1)No pest records
25	<i>Pineapple</i>	<i>wilt</i>	No information	No information	Pineapple mealybug wilt	Leaves, roots, and fruits/pods.	PM, Sa, Swk	C2, L1	A(1)(K.G.Singh,1980)	P(5)(Lim WH,1985)
26	<i>Pseudomonas</i>	<i>ananas</i>	Pseudomonadales	Pseudomonadaceae	Bacterial fruitlet rot	Fruits/pods.	PM	C2, L1	P(5)(K.G.Singh,1980)	A(1)No pest records
27	<i>Stachylidium</i>	<i>bicolor</i>	No information	No information	No information	No information	Sa	L1	A(5)(K.G.Singh,1980)	A(1)No pest records
28	<i>Stilbella</i>	<i>proliferans</i>	Hypocreales	No information	No information	Leaves	Sa	L1	A(5)(K.G.Singh,1980)	A(1)No pest records
29	<i>Stomiopeltis</i>	<i>sp.</i>	No information	Micropeltidaceae	Sooty mould	No information	PM	L1	P(5)(K.G.Singh,1980)	A(1)No pest records

REFERENCE:

- 1 Anon., 1992. *Panduan Kawalan Serangga Perosak dan Penyakit Buah-buahan*. Jabatan Pertanian Kuala Lumpur, Technical Reference 69: 57-58
- 2 Anon., 1999. *Pakej Teknologi Nanas*. Jabatan Pertanian Semenanjung Malaysia, JP/Bk 02.10/12-99/1.2R: 24
- 3 Lim WH, 1985. *Diseases and Disorders of Pineapples in Peninsular Malaysia*. Malaysian Agricultural Research and Development Institute (MARDI) Report, 97: 15-16, 22-24.
- 4 K.G.Singh (1980), A Check List of Host And Disease In Malaysia. Ministry of Agriculture.
- 5 Y. Ahmad & H.T. Ho (1980), List of Economic Pests, host Plants, Parasites and Predators in West Malaysia. Ministry of Agriculture

CODE

PM	Peninsular Malaysia
Swk	Sarawak
Sa	Sabah

VERIFICATION CODE

C1	Collection centre
C2	Compendium
L1	Literature/ Jurnal /Publication
P1	Personel Communication
S1	Survey

**STATUS
CODE**

A(1)	Absent : no pest records
A(2)	Absent ; pest no longer present
A(3)	Absent : pest records invalid
A(4)	Absent ; pest records unreliable
A(5)	Absent : intercepted only
P(1)	Present : in all parts of the area
P(2)	Present : only in some areas
P(3)	Present : except in specified pest free areas
P(4)	Present : in all parts of the area where host crop(s) are grown
P(5)	Present : only in some area where host crop(s) are grown
P(6)	Present : only in protected cultivation
P(7)	Present : seasonally
P(8)	Present : but managed
P(9)	Present : subject to official control
P(10)	Present : under eradication
P(11)	Present : at low prevalence
T(1)	Transience : non-actionable
T(2)	Transience : actionable, under surveillance
T(3)	Transience : actionable, under eradication

***DISEASE FACT SHEET
OF
PINEAPPLE***

1.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Antennularis</i> sp.
Common name	No information
Domain	No information
Kingdom	No information
Other Names	No information
Distribution	Peninsular Malaysia; leaf; (Singh KG, 1980)
Status	No information
Biology, Ecology & Morphology	No information.
Affected Plant Stages	No information
Affected Plant Parts	Leaf
Symptom	No information
Damage	No information
Host	<i>Ananas comosus</i> (pineapple) (Singh KG, 1980).
Control	<i>No information.</i>
References	1. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i> , Ministry of Agriculture : 8-9, 190

2.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Asterinella stuhlmanni</i> (P. Henn). Theiss.
Common name	Leaf spot
Domain	Eukaryota
Kingdom	Fungi
Phylum	Ascomycota
Class	Ascomycetes
Order	Microthyriales
Family	Microthyriaceae
Other Names	No information
Distribution	Peninsular Malaysia, Sabah; leaf; (Singh KG, 1980)
Status	No information
Biology, Ecology & Morphology	No information
Affected Plant Stages	No information
Affected Plant Parts	Leaf
Symptoms	Leaf spots (Singh KG, 1980)
Damage	No information
Host	Primary host: <i>Ananas comosus</i> (pineapple) (CABI, 2002; Singh KG, 1980).
Control	<i>No information.</i>
References	<ol style="list-style-type: none"> 1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International, 2002. 2. Kirk PM, Cannon PF, David JC, Stalpers JA, 2001. <i>Dictionary of The Fungi, 9th Edition</i>. CAB International : 41, 49, 165, 323, 324 3. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 192

3.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Beltrania rhombica</i> O. Penzig, 1882
Common name	Leaf spot
Domain	Eukaryota
Kingdom	Fungi
Phylum	'Mitosporic fungi' (Anamorphic fungi)
Class	Hyphomycetes
Other Names	<i>Beltrania indica</i> Subramaniam <i>Beltrania multispora</i> Swart
Distribution	Peninsular Malaysia; (Singh KG, 1980)
Status	Non-pathogenic to pineapple.
Biology, Ecology & Morphology	The colonies are effuse, velutinous and brown to black. The setae are smooth and usually less than 200 μ m long but occasionally up to 300 μ m, 4-6 μ m thick near the base. The conidiophores are up to 130 μ m long and 4-8 μ m thick. The conidia are 15-30 x 7-14 μ m in size with appendage of 3-20 μ m long and 2 μ m wide at base. The conidia are biconic symmetrical with the proximal end v-shaped (Ellis MB,1971).
Hosts	On dead leaves of many tropical plants including lime, pineapple and tea (Ellis MB,1971).
Control	-
References	<ol style="list-style-type: none"> 1. Ellis MB, 1971. <i>Dematiaceous Hyphomycetes</i>. Commonwealth Mycological Institute (CMI) : 237 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9

4.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Lasiodiplodia theobromae</i> (Pat.) Griffiths & Maubl. [anamorph] (preferred name for <i>Botryodiplodia theobromae</i> Pat)
Common name	Leaf blight
Domain	Eukaryota
Kingdom	Fungi
Phylum	Ascomycota
Class	Ascomycetes
Order	Xylariales
Family	Hyponectriaceae
Other Names	<p><i>Botryodiplodia ananassae</i> (Sacc.) Petr. <i>Botryodiplodia elasticae</i> Petch <i>Botryodiplodia gossypii</i> Ellis & Barthol <i>Botryodiplodia tubericola</i> (Ellis & Everh.) Petr. <i>Chaetodiplodia grisea</i> Petch <i>Diplodia ananassae</i> Sacc. <i>Diplodia cacaoicola</i> Henn. <i>Diplodia gossypina</i> Cooke <i>Diplodia natalensis</i> Pole-Evans <i>Diplodia theobromae</i> (Pat.) W. Nowell <i>Diplodia tubericola</i> (Ellis & Everh.) Taubenh <i>Lasiodiplodia triflorae</i> B. B. Higgins <i>Lasiodiplodia tubericola</i> Ellis & Everh. <i>Macrophomina vestita</i> Prillinger & Delacr. <i>Botryodiplodia theobromae</i> Pat. [anamorph] <i>Botryosphaeria rhodina</i> (Cooke) Arx [teleomorph] <i>Physalospora rhodina</i> Berk. & M.A. Curtis [teleomorph]</p>
Distribution	Sarawak ; Leaves; (Singh KG, 1980)
Status	Not recorded in Peninsular Malaysia (Lim WH, 1985).
Biology, Ecology & Morphology	<i>B. theobromae</i> is a plurivorous, wound and secondary pathogen, and a saprophyte which is particularly common at relatively high temperatures. It is soilborne, seedborne, air-borne, insect transmitted and occurs as endophytes. It sporulates readily on host tissue on incubation. Infections usually occur when there is a wound in the host tissue. Conidiomata (pycnidia) are produced with fluffy mycelium, and optimum growth is obtained at 30°C (CABI, 2002).
Affected Plant Stages	No information.
Affected Plant Parts	Leaves.
Symptoms	No information
Damage	No information.

Hosts	<p>Primary hosts: <i>Citrus</i>, <i>Theobroma cacao</i> (cocoa), <i>Arachis hypogaea</i> (groundnut), <i>Gossypium</i> (cotton), <i>Musa</i> (banana), <i>Mangifera indica</i> (mango), <i>Zea mays</i> (maize), <i>Allium</i> (onions, garlic, leek, etc.), <i>Ananas comosus</i> (pineapple), <i>Araucaria cunninghamii</i> (colonial pine), <i>Cocos nucifera</i> (coconut), <i>Capsicum annuum</i> (bell pepper), <i>Dioscorea</i> (yam), <i>Hevea brasiliensis</i> (rubber).</p> <p>Secondary hosts: <i>Cucumis melo</i> (melon), <i>Ipomoea batatas</i> (sweet potato), <i>Manihot esculenta</i> (cassava), <i>Musa balbisiana</i>, <i>Nicotiana tabacum</i> (tobacco), <i>Oryza sativa</i> (rice), <i>Saccharum officinarum</i> (sugarcane), <i>Sorgh</i>, <i>Carica papaya</i> (papaw), <i>Capsicum</i> (peppers), <i>Daucus carota</i> (carrot), <i>Psidium guajava</i> (common guava), (CABI, 2002).</p>
Control	No information.
References	<ol style="list-style-type: none"> 1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International, 2002. 2. Lim WH, 1985. <i>Diseases and Disorders of Pineapples in Peninsular Malaysia</i>. Malaysian Agricultural Research and Development Institute (MARDI) Report, 97:43. 3. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9

5.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Capnodium</i> sp.
Common name	Sooty mould
Domain	Eukaryota
Kingdom	Fungi
Phylum	Ascomycota
Class	Ascomycetes
Order	Capnodiales
Family	Capnodiaceae
Other Names	-
Distribution	Peninsular Malaysia; (Singh KG, 1980)
Status	No information.
Biology, Ecology & Morphology	No information
Affected Plant Stages	No information
Affected Plant Parts	No information
Symptoms	No information
Damage	No information
Hosts	<i>Ananas comosus</i> , <i>Cattleya</i> sp., <i>Citrus</i> spp., <i>Cocos nucifera</i> , <i>Enterolobium saman</i> , <i>Hibiscus mutabilis</i> , <i>Lantana camara</i> , <i>Pellacalyx saccardianus</i> , <i>Phaleonopsis</i> sp., <i>Spathoglottis</i> sp., <i>Vanda</i> sp. (Singh KG, 1980)
Control	No information.
References	<ol style="list-style-type: none"> 1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International, 2002. 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 194

6.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Ceratocystis paradoxa</i> (Dade) C. Moreau [teleomorph] (perfect stage of <i>Thielaviopsis paradoxa</i>)
Common name	Thielaviopsis soft rot, Thielaviopsis fruit rot, base rot, butt rot, White leaf spot
Domain	Eukaryota
Kingdom	Fungi
Phylum	Ascomycota
Class	Ascomycetes
Order	Microascales
Family	Ceratocystidaceae
Other Names	<i>Thielaviopsis paradoxa</i> (De Seynes) Höhn. [anamorph] <i>Chalara paradoxa</i> (De Seynes) Sacc [anamorph] <i>Ceratostomella paradoxa</i> Dade [teleomorph] <i>Endoconidium fragrans</i> E.G. Lacroix [teleomorph] <i>Hughesiella euricoi</i> Bat. & A.F. Vital [teleomorph] <i>Ophiosstoma paradoxa</i> (Dade) Nannf [teleomorph] <i>Sporoschisma paradoxum</i> De Seynes [teleomorph] <i>Stilbochalara dimorpha</i> Ferd. & Winge [teleomorph] <i>Thielaviopsis ethacetica</i> Went [teleomorph]
Distribution	Peninsular Malaysia: present (Singh KG, 1980); Fruit, stem/stalk/base, leaf (Lim WH, 1985)
Status	Minor – fruit: a post-harvest problem and rarely seen in field, heart and leaves: rare incidence (Lim WH, 1985)
Biology, Ecology & Morphology	Culture of <i>Thielaviopsis paradoxa</i> is initially hyaline with scanty floccose aerial mycelium and is a fast-growing fungus. After two days, the colony becomes greenish-grey (Lim WH, 1985). The colonies are dark blackish brown to black whilst the conidiophores are colourless to pale brown (Ellis MB, 1971). The macroconidia are borne in chains and are dark brown, thick-walled, smooth, oval to ovoid, about 18.3 μm long x 9.7 μm wide. The endoconidia are also borne in chains and are hyaline to light brown, thin-walled, smooth, rectangular, about 10.7 μm long x 5.6 μm wide (Lim WH, 1985). Infection of the fungus takes place through the cut end of the peduncle or through other wounds on the fruits, wound at the base and also wounded leaves (Lim WH, 1985).
Affected Plant Stages	Vegetative growing stage, flowering stage, fruiting stage, and post-harvest.
Affected Plant Parts	Leaves, stems/base and fruits.

<p>Symptoms</p>	<p><i>Fruit</i> The disease causes soft watery rot of the fruit flesh which turns grayish with time. The fruit skin of the infected region is glassy, water-soaked and brittle. The rot always give a sweet ester-like odour. When the infected surface is exposed, the fungus sporulates and produce masses of black spores. This disease is a post-harvest problem and also confined to over-ripe fruits or fruits damaged by pests in the field (Lim WH, 1985).</p> <p><i>Stem/Base</i> This fungus causes a soft watery and macerated base rot extended towards the meristem. The rot may spread to the base of the leaves under humid condition. The rot appears as a brownish lesion with a sweet ester-like odour which eventually turns grayish-black upon production of spores (Lim WH, 1985).</p> <p><i>Leaf</i> White leaf spot is most prevalent in younger leaves and rarely attack older plants. The disease starts as a small brownish wet rot with a dark green border. The lesion spreads rapidly and becomes grayish-brown bordered by a dark brown band at its edge. The infected region eventually dries up and becomes light brown and papery (Lim WH, 1985).</p>
<p>Damage</p>	<p>Thielaviopsis soft rot of the fruit is essentially a post-harvest problem and rarely seen in the field where present is usually confined to over-ripened fruits or fruits damaged by pests (Lim WH, 1985). Butt rot is commonly observed on pineapple slips heaped in a big stack in the field (Lim WH, 1985; Anon. 1999). White leaf spot is rarely encountered and is of no economic importance (Lim WH, 1985).</p>
<p>Hosts</p>	<p>Primary hosts: <i>Saccharum officinarum</i> (sugarcane), <i>Araceae</i>, <i>Ananas comosus</i> (pineapple), <i>Cocos nucifera</i> (coconut), <i>Coffea</i> (coffee), <i>Elaeis guineensis</i> (African oil palm), <i>Mangifera indica</i> (mango), <i>Musa paradisiaca</i> (plantain), <i>Theobroma cacao</i> (cocoa), <i>Zea mays</i> (maize).</p> <p>Secondary hosts: <i>Palmae</i> (plants of the palm family) (CABI, 2002)</p>
<p>Control</p>	<p><i>Cultural</i></p> <ol style="list-style-type: none"> 1. In order to avoid any incidence of the disease, extra care must be taken during harvesting and handling of fruits. 2. Avoid stacking planting materials especially in high humidity area (Anon., 1992) <p><i>Chemical</i></p> <ol style="list-style-type: none"> 1. For long distance transportation of pineapples, the disease can be overcome by dipping the cut end of the peduncle into benzoic acid. 2. Pre-plant fungicidal dip - the fresh planting materials are immersed in fungicides or Bordeaux solution before planting (Anon., 1992).
<p>References</p>	<ol style="list-style-type: none"> 1. Anon., 1992. <i>Panduan Kawalan Serangga Perosak dan Penyakit Buah-buahan</i>. Jabatan Pertanian Kuala Lumpur, Technical Reference 69: 57-58 2. Anon., 1999. <i>Pakej Teknologi Nanas</i>. Jabatan Pertanian Semenanjung Malaysia, JP/Bk 02.10/12-99/1.2R: 24 3. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International, 2002. 4. Ellis MB, 1971. <i>Dematiaceous Hyphomycetes</i>. Commonwealth Mycological Institute (CMI) : 31

	<ol style="list-style-type: none"><li data-bbox="501 194 1374 286">5. Lim WH, 1985. <i>Diseases and Disorders of Pineapples in Peninsular Malaysia</i>. Malaysian Agricultural Research and Development Institute (MARDI) Report, 97: 15-16, 22-24.<li data-bbox="501 315 1433 376">6. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 195
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7.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Clonostachus</i> sp.
Common name	No information
Domain	No information
Kingdom	No information
Phylum	No information
Class	No information
Order	No information
Family	No information
Other Names	No information
Distribution	Peninsular Malaysia ; Leaves (Singh KG, 1980)
Status	No information
Biology, Ecology & Morphology	No information
Affected Plant Stages	No information
Affected Plant Parts	Leaves
Symptoms	No information
Damage	No information
Host	<i>Ananas comosus</i> (Singh KG,1980)
Control	<i>No information</i>
References	1. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i> , Ministry of Agriculture : 8-9, 201

8.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Cochliobolus geniculatus</i> Nelson
Common name	-
Domain	Eukaryota
Kingdom	Fungi
Phylum	Ascomycota
Class	Ascomycetes
Order	Pleosporales
Family	Pleosporaceae
Other Names	<i>Pseudocochliobolus geniculatus</i> <i>Curvularia geniculata</i> (Tracy & Earle) Boedijn
Distribution	Sabah; Leaves; (Singh KG, 1980)
Status	No information.
Biology, Ecology & Morphology	No information.
Affected Plant Stages	No information.
Affected Plant Parts	Leaves
Symptoms	No information.
Damage	No information.
Hosts	<i>Allium tuberosum</i> , Ananas comosus , <i>Anona muricata</i> , <i>Cucumis</i> , <i>Cymbopogon citrates</i> , <i>Capsicum</i> (peppers), <i>Elaeis</i> ,, <i>Oryza sativa</i> (rice) (Singh KG, 1980).
Control	-
References	<ol style="list-style-type: none"> 1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International, 2002. 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 201

9.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Colletotrichum capsici</i> (Syd.) Butler & Bisby
Common name	Leaf tip dieback
Domain	Eukaryota
Kingdom	Fungi
Phylum	'Mitosporic fungi' (Anamorphic fungi)
Other Names	-
Distribution	Peninsular Malaysia ; Leaves; (Singh KG, 1980)
Status	No information
Biology, Ecology & Morphology	No information
Affected Plant Stages	No information
Affected Plant Parts	Leaves
Symptoms	No information
Damage	No information
Host	<i>Ananas comosus</i> , <i>Arachis hypogaea</i> , <i>Asparagus officinalis</i> , <i>Averrhoa carambola</i> , <i>Basella rubra</i> , <i>Bougainvillea</i> sp., <i>Brassica oleracea</i> , <i>Caladium</i> sp., <i>Capsicum annum</i> , <i>C. grossum</i> , <i>Cassia occidentalis</i> , <i>Carica papaya</i> , <i>Crotalaria striata</i> , <i>dahlia hybrid</i> , <i>Dioscorea</i> sp., <i>Elaeis guineensis</i> , <i>Gerbera jamesonii</i> , <i>Glycine max</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lilium</i> sp., <i>Lycopersicon esculentum</i> , <i>Piper nigrum</i> , <i>Raphanus sativus</i> L. var. <i>hortensi</i> , <i>Sauropus androgynus</i> , <i>Solanum hyporhodium</i> , <i>S.melongena</i> , <i>Vigna sinensis</i> (Singh KG, 1980)
Control	-
References	<ol style="list-style-type: none"> 1. Kirk PM, Cannon PF, David JC, Stalpers JA, 2001. <i>Dictionary of The Fungi, 9th Edition</i>. CAB International : 121 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 202

10.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Colletotrichum</i> sp.
Common name	Anthracnose
Domain	Eukaryota
Kingdom	Fungi
Phylum	'Mitosporic fungi' (Anamorphic fungi)
Other Names	-
Distribution	Peninsular Malaysia ; Leaves; (Lim WH, 1985)
Status	No information
Biology, Ecology & Morphology	Acervuli disc-shaped or cushion-shaped, waxy, subepidermal, typically with dark, spines or setae at the edge or among the conidiophores; conidiophores simple, elongate; conidia hyaline, 1-celled, ovoid or oblong; parasitic; imperfect states of <i>Glomerella</i> (Barnett HL, Hunter BB, 1972)
Affected Plant Stages	Seedling stage and vegetative growing stage.
Affected Plant Parts	Leaves.
Symptoms	The disease is characterized by irregular leaf spots ranging from small (1-2mm) to extensive (30mm). The lesions are found on the apex, sides and center of the leaves. Distinct black fruiting bodies are arranged in concentric zones on the lesions (Lim WH, 1980).
Damage	In Peninsular Malaysia, anthracnose was first observed in a pineapple nursery in Johore in 1974 where about 80% of three-month-old hybrid seedlings were affected (Lim WH, 1980).
Host	<i>Ananas comosus</i> (Lim WH, 1985). No further information.
Control	<i>Chemical</i> Regular sprays with benomyl or maneb at the recommended dosages are effective in controlling the disease.
References	<ol style="list-style-type: none"> 1. Barnett HL, Hunter BB, 1972. <i>Illustrated Genera of Imperfect Fungi</i>, 3rd Edition. p200. 2. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International, 2002. 3. Kirk PM, Cannon PF, David JC, Stalpers JA, 2001. <i>Dictionary of The Fungi</i>, 9th Edition. CAB International : 121 4. Lim WH, 1985. <i>Diseases and Disorders of Pineapples in Peninsular Malaysia</i>. Malaysian Agricultural Research and Development Institute (MARDI) Report, 97:24-25

11.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Pseudocochliobolus eragrostidis</i> Tsuda & Ueyama (preferred name for <i>Curvularia eragrostidis</i>)
Common name	Leaf rot, pineapple leaf blight
Domain	Eukaryota
Kingdom	Fungi
Phylum	Ascomycota
Class	Ascomycetes
Order	Pleosporales
Family	Pleosporaceae
Other Names	<i>Cochliobolus eragrostidis</i> (Tsuda & Ueyama) Sivan. <i>Curvularia eragrostidis</i> (Henn.) J.A.Meyer
Distribution	Sarawak; Leaf; (Singh KG, 1980)
Status	Not recorded in Peninsular Malaysia (Lim WH, 1985)
Biology, Ecology & Morphology	No information.
Affected Plant Stages	No information.
Affected Plant Parts	Leaves.
Symptoms	No information.
Damage	No information.
Hosts	<i>Agave</i> , <i>Ananas comosus</i> , <i>Arachis</i> , <i>Digitaria</i> , <i>Eragrostis</i> , <i>Furcraea</i> , <i>Hevea brasiliensis</i> (rubber), <i>Ipomoea</i> , <i>Oldenlandia</i> , <i>Saccharum</i> , <i>Sesamum</i> , <i>Sorghum</i> , <i>Sporobolus</i> , <i>Zea</i> , <i>Phalaenopsis amabilis</i> , <i>Pinus caribaea</i> , <i>Asparagus officinalis</i> (asparagus), <i>Cocos nucifera</i> (coconut), <i>Dioscorea</i> (yam), <i>Elaeis guineensis</i> (oil palm), <i>Gladiolus hybrids</i> (sword lily), <i>Oryza sativa</i> (rice) (Ellis MB, 1971; CABI, 2002; Singh KG, 1980)
Control	<i>No information.</i>
References	<ol style="list-style-type: none"> 1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International, 2002. 2. Ellis MB, 1971. <i>Dematiaceous Hyphomycetes</i>. Commonwealth Mycological Institute (CMI) : 456 3. Lim WH, 1985. <i>Diseases and Disorders of Pineapples in Peninsular Malaysia</i>. Malaysian Agricultural Research and Development Institut (MARDI) Report, 97:43. 4. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 208

12.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Curvularia lunata</i> (Wakker) Boedijn [anamorph]
Common name	Leaf spot (Singh KG, 1980)
Domain	Eukaryota
Kingdom	Fungi
Phylum	'Mitosporic fungi' (Anamorphic fungi)
Class	Hyphomycetes
Other Names	<i>Cochliobolus lunatus</i> R.R. Nelson & Haasis (preferred name) <i>Acrothecium lunatum</i> Wakker [anamorph] <i>Pseudocochliobolus lunatus</i> (R.R. Nelson & Haasis) Tsuda et al. [teleomorph]
Distribution	Peninsular Malaysia; Leaves; (Singh KG, 1980)
Status	No information.
Biology, Ecology & Morphology	Conidiophores brown, mostly simple, bearing spores apically or on new sympodial growing points (Barnett HL, Hunter BB, 1972). Conidia are smooth walled and predominantly 3 septate. Conidia curved with some conidial cells always mid or dark brown and about 18-32 x 8-16 μ m. Stromata very rarely formed in culture, colonies on PDA not markedly zonate (Ellis, 1971).
Affected Plant Stages	No information.
Affected Plant Parts	No information.
Symptoms	No information.
Damage	No information.
Hosts	<i>Ananas comosus</i> , <i>Axonopus affinis</i> , <i>Boehmeria nivea</i> , <i>Elaeis guineensis</i> , <i>Oncidium</i> sp., <i>Oryza sativa</i> , <i>Phalaenopsis amabilis</i> , <i>Piper betle</i> , <i>Saccharum officinarum</i> , <i>Sorghum vulgare</i> , <i>Syzygium aromaticum</i> , <i>Theobroma cacao</i> , <i>Thuja orientalis</i> , <i>Zea mays</i> , <i>Zoysia matrella</i> (Singh KG, 1980)
Control	No information.
References	<ol style="list-style-type: none"> 1. Barnett HL, Hunter BB, 1972. <i>Illustrated Genera of Imperfect Fungi</i>, 3rd Edition. p118. 2. Ellis MB, 1971. <i>Dematiaceous Hyphomycetes</i>. Commonwealth Mycological Institute (CMI) : 453 3. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 209

13.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Curvularia maculans</i> (Bancroft) Boedijn
Common name	Leaf spot (Singh KG, 1980)
Domain	Eukaryota
Kingdom	Fungi
Phylum	' Mitosporic fungi' (Anamorphic fungi)
Class	Hyphomycetes
Other Names	No information.
Distribution	Peninsular Malaysia; Leaves; (Singh KG, 1980)
Status	No information.
Biology, Ecology & Morphology	Conidiophores brown mostly simple, bearing spores apically or on new sympodial growing points. Conidia are dark, end cells lighter, 3- to 5-celled, more or less fusiform. Typically bent with one of the central cells enlarged (Barnett HL, Hunter BB, 1972).
Affected Plant Stages	No information
Affected Plant Parts	Leaves
Symptoms	No information
Damage	No information
Hosts	<i>Ananas comosus</i> , <i>Cocos nucifera</i> , <i>Elaeis guineensis</i> , <i>Furcraea gigantea</i> , <i>Saccharum officinarum</i> , <i>Zea mays</i> (Singh KG, 1980).
Control	No information.
References	<ol style="list-style-type: none"> 1. Barnett HL, Hunter BB, 1972. <i>Illustrated Genera of Imperfect Fungi</i>, 3rd Edition. p118. 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 209

14.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Pantoea ananas</i> pv. <i>ananas</i> (Serrano 1928) Mergaert et al. 1993 (Preferred name for <i>Erwinia ananas</i>)
Common name	Marbled fruit disease, fruitlet brown rot, fruitlet black rot, bacterial fruitlet rot
Domain	Bacteria
Phylum	Proteobacteria
Class	Gammaproteobacteria
Order	Enterobacteriales
Family	Enterobacteriaceae
Other names	<i>Bacillus ananas</i> Serrano 1928 <i>Bacterium ananas</i> (Serrano) Burgvits 1935 <i>Chromobacterium ananas</i> (Serrano) Krasil'nikov 1949 <i>Erwinia ananas</i> Serrano 1928 <i>Erwinia ananas</i> pv. <i>ananas</i> Serrano 1928 <i>Erwinia herbicola</i> var. <i>ananas</i> (Serrano) Dye 1969 <i>Pectobacterium ananas</i> (Serrano) Patel & Kulkarni 1951
Distribution	Malaysia: present, no further details; fruit; (Singh KG,1980; Lim WH, 1985)
Status	No information
Biology, Ecology & Morphology	The disease is spread by wind, rain and insects. The bacterium appeared to enter the fruit through the open flowers. The disease is most prevalent during warm weather especially on large succulent fruits which have relatively low acidity (Lim WH, 1985).
Affected Plant Stages	Fruiting stage
Affected Plant Parts	Fruits/pods.
Symptoms	At early stage, a tangential section of the fruit reveals brown discolouration of one or all three placental lobes of the fruitlets. Usually the rot is about 3 cm deep and does not extend beyond the base of one or more of the locules, however, sometimes the rot is extensive reaching to the core. The lesion is mottled bone brown (yellowish brown to dark brown) and is drier and harder than the surrounding healthy tissue, characteristically speckled or stippled against a whitish background. Solid masses of brown may occur in the fruitlet core. The discolouration is limited to the placental lobes although frequently the entire fruitlet is affected. In severely affected fruits, transverse sections show the diseased portions radiating around the core, giving a variegated appearance. The term marbled fruit was used to describe the disease because of the characteristic hardening of the tissues (Lim WH, 1985).
Damage	In Malaysia, the disease was rarely encountered in which not more than one percent of the fruits the cannery were affected by the disease. The disease was found to be common on Hybrid 1 pineapples and could be a potential serious problem of the cultivar where losses of more than 40% having been recorded. The disease had also been observed to cause heavy losses on the Gandul, a low fruit-acid cultivar (Lim WH, 1985).

Hosts	Primary hosts: Ananas comosus (pineapple) (Singh KG, 1980) <i>Saccharum officinarum</i> (sugarcane), <i>Cucumis melo</i> (melon) (CABI, 2002)
Control	<u>Cultural</u> 1. Increase the planting density to reduce fruit size since smaller fruits have higher acid content thus less prone to infection (Lim WH, 1985) <u>Chemical</u> 3. Increase the fruit acidity by applying potassium sulphate (Lim WH, 1985)
References	1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i> . CAB International. 2. Lim WH, 1985. <i>Diseases and Disorders of Pineapples in Peninsular Malaysia</i> . Malaysian Agricultural Research and Development Institut (MARDI) Report, 97:12-14 3. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i> , Ministry of Agriculture : 8-9, 255

15.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Erwinia chrysanthemi</i> (Burkh.) Young et al. 1978
Common name	Fruit collapse, ghost fruit, bacterial heart rot
Domain	Bacteria
Phylum	Proteobacteria
Class	Gammaproteobacteria
Order	Enterobacteriales
Family	Enterobacteriaceae
Other names	<i>Erwinia carotovora</i> f.sp. <i>parthenii</i> Starr <i>Erwinia carotovora</i> f.sp. <i>zeae</i> Sabet <i>Erwinia carotovora</i> var. <i>chrysanthemi</i> (Burkh.) Dye <i>Erwinia dieffenbachiae</i> MacFadden <i>Erwinia maydis</i> Starr <i>Erwinia paradisiaca</i> Fernandez-Borrero & Lopez-Duque <i>Pectobacterium carotovorum</i> f. sp. <i>chrysanthemi</i> (Burkh.) Dowson <i>Pectobacterium carotovorum</i> var. <i>chrysanthemi</i> (Burkh.) Graham & Dowson <i>Pectobacterium carotovorum</i> var. <i>graminarum</i> Dowson & Hayward <i>Pectobacterium chrysanthemi</i> (Burkh.) Brenner et al. <i>Pectobacterium chrysanthemi</i> pv. <i>zeae</i> (Sabet) Brenner et al. <i>Pectobacterium parthenii-dianthicola</i> Hellmers
Distribution	Peninsular Malaysia: present (Singh KG, 1980; Lim WH, 1985); Fruit, heart, leaves, stem (Lim WH, 1985)
Status	0% to 40% loss per field (Lim WH, 1985)
Biology, Ecology & Morphology	<p>Motile rods, 0.7x 2.2μm, non-sporing, occurring singly or occasionally in pairs with a few peritrichous flagella. The bacteria produce whitish-yellow translucent colonies, filiform, glistening, slightly iridescent, butyrous with wavy to lobate margin when grown on potato dextrose yeast agar The bacteria is a gram negative bacteria, indole positive, methyl red test negative and phosphatase positive. It produces acid from glucose, fructose, sucrose, raffinose, galactose, xylose, arabinose, rhamnose, salicin, glycerol, mannitol and ethanol (Lim WH, 1985).</p> <p><i>Fruit</i> The pathogen enters the fruit via the open flowers and can be carried by ants (<i>Pheidole</i> and <i>Iridomyrmex</i>) to the flowers and thus transmit the bacteria to the style. The pathogen then moves along the canal of the style to the base where it remains latent within the ovary. The bacteria would proliferate to infect the rest of the fruit two to three weeks before ripening. The bacteria can also be transmitted by wind, rain splash and also several species of souring beetles, <i>Haptoncus</i> and <i>Carpophilus</i> which inhibit the collapsed fruit (Lim WH, 1985).</p> <p><i>Stem</i> Infection takes place on the aerial portions through the stomata of the young heart leaves in which the bacteria can be transmitted by insects, rain-splash or wind (Lim WH, 1985).</p>
Affected Plant Stages	Vegetative growing stage, flowering stage and fruiting stage.
Affected Plant Parts	Heart, leaves and fruits/pods.

<p>Symptoms</p>	<p><i>Fruit</i> Fruit normally develop symptoms at about two to three weeks before ripening. The disease causes copious exudation of fluid from the interfuitlet fissures accompanied by bubbles of gas. The skin eventually turns to olive green from the healthy dark purplish-red. If the infected fruit is dissected, only skeletal fibres are found and separated by cavities within (Lim WH, 1985).</p> <p><i>Stem</i> Infected plants show symptoms of water-soaked lesions arising from the base of the central whorl of leaves. The lesion spreads into the green portion of leaves and then stop spreading forming a dark infection border. The upper surface of the infected leaves becomes bloated due to the accumulation of gas. Infected region will rot and becomes watery producing a putrefying odour. The whole heart can be easily detached from the plant upon infection (Lim WH, 1985; Anon., 1992).</p>
<p>Damage</p>	<p>A survey of the pineapple growing areas in Johore, covering a total of 12 000 hectares also indicated that the percentage loss per harvesting season ranged from 0%-40% per field (Lim WH, 1985)</p>
<p>Hosts</p>	<p>Primary hosts: <i>Chrysanthemum vestitum</i>, <i>Araceae</i>, <i>Aglaonema</i>, <i>Aloe vera</i>, <i>Allium</i> (onions, garlic, leek, etc.), <i>Brassica oleracea</i> (cabbages, cauliflowers), <i>Chrysanthemum maximum hybrids</i>, <i>Dieffenbachia</i> (dumbcanes), <i>Dianthus</i> (carnation),.</p> <p>Secondary hosts: <i>Allium cepa</i> (onion), <i>Allium fistulosum</i> (Welsh onion), <i>Allium sativum</i> (garlic), <i>Ananas comosus</i> (pineapple), <i>Brassica oleracea</i> var. capitata (cabbage), <i>Capsicum annuum</i> (bell pepper), <i>Dianthus caryophyllus</i> (carnation), <i>Lycopersicon esculentum</i> (tomato), <i>Cucumis melo</i> (melon), <i>Dahlia pinnata</i>, <i>Daucus carota</i> (carrot), <i>Euphorbia pulcherrima</i> (poinsettia), <i>Helianthus annuus</i> (sunflower), <i>Hyacinthus</i>, <i>Ipomoea batatas</i> (sweet potato), <i>Lactuca sativa</i> (lettuce), <i>Nicotiana tabacum</i> (tobacco), <i>Oryza sativa</i> (rice), <i>Paspalum</i>, <i>Phalaenopsis</i>, <i>Saccharum officinarum</i> (sugarcane), <i>Solanum tuberosum</i> (potato), <i>Tulipa</i> (tulip), <i>Zea mays</i> (maize) (CABI, 2002).</p>
<p>Control</p>	<p><u>Chemical and Cultural</u></p> <ol style="list-style-type: none"> 1. Destroy infected fruits and plants 2. Spray ground with insecticides before flowering and repeat after two weeks to control ants population 3. Use healthy planting materials 4. Use planting materials resistant to the disease such as Sarawak and Smooth Cayenne (Anon., 1992; Anon., 1999).
<p>References</p>	<ol style="list-style-type: none"> 1. Anon., 1992. <i>Panduan Kawalan Serangga Perosak dan Penyakit Buah-buahan</i>. Jabatan Pertanian Kuala Lumpur, Technical Reference 69: 54, 59 2. Anon., 1999. <i>Pakej Teknologi Nanas</i>. Jabatan Pertanian 3. Semenanjung Malaysia, JP/Bk 02.10/12-99/1.2R: 24 4. CABI (2002), <i>Crop Protection Compendium 2002 Edition</i>. CAB International. 5. Lim WH, 1985. <i>Diseases and Disorders of Pineapples in Peninsular Malaysia</i>. Malaysian Agricultural Research and Development Institut (MARDI) Report, 97: 1-4, 20-21. 6. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 255

16.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Gibberella fujikuroi</i> (Sawada) S. Ito [teleomorph] (preferred name for <i>Fusarium moniliforme</i> Sheldon)
Common name	Fruitlet core rot, black eye, black spot or black rot
Domain	Eukaryota
Kingdom	Fungi
Phylum	Ascomycota
Class	Ascomycetes
Order	Hypocreales
Family	Nectriaceae
Other Names	<i>Fusarium moniliforme</i> Sheldon <i>Lisea fujikuroi</i> Sawada <i>Gibberella moniliforme</i> [teleomorph]
Distribution	Peninsular Malaysia; Fruit; (Singh KG, 1980)
Status	Minor – sporadic disease (Lim WH, 1985)
Biology, Ecology & Morphology	The infection of <i>Fusarium moniliforme</i> primarily occurred on the young emerging inflorescence and during as well as after anthesis (Lim WH, 1985)
Affected Plant Stages	Fruiting stage.
Affected Plant Parts	Fruit.
Symptoms	Fruitlet core rot is characterized by a brownish almost black wet rot developing in the tissues of the fruitlet core. The rot is usually restricted within the fruitlet, although it may extend into the core (Lim WH, 1985).
Damage	This is a sporadic disease and epiphytotic have rarely been encountered. Records made at different times in the past indicated that mean percentage incidences (number infected fruits/total) ranged from 0-28%. However, in most cases, although the percentage of infected fruits may be high, the actual number of infected eyes per fruit is relatively few. A large proportion of the fruit can still be used for canning (Lim WH, 1985).
Hosts	<i>Oryza sativa</i> (rice), <i>Lycopersicon esculentum</i> (tomato), <i>Musa</i> (banana), <i>Pinus</i> (pines), <i>Saccharum officinarum</i> (sugarcane), <i>Sorghum</i> , <i>Vigna unguiculata</i> (cowpea), <i>Zea mays</i> (maize), <i>Manilkara zapota</i> (sapodilla), <i>Solanum melongena</i> (aubergine), <i>Sorghum bicolor</i> (common sorghum), <i>Glycine max</i> , (CABI, 2002; Singh KG, 1980) Ananas comosus (pineapple) (Lim WH, 1985)
Control	No chemical control has been worked out, primarily because of the sporadic nature and the relatively lesser importance of the disease (Lim WH, 1985).
References	<ol style="list-style-type: none"> 1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International, 2002. 2. Lim WH, 1985. <i>Diseases and Disorders of Pineapples in Peninsular Malaysia</i>. Malaysian Agricultural Research and Development Institute (MARDI) Report, 97:43. 3. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9

17.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Gliomastix luzulae</i> (Fuckel) Mason
Common name	-
Domain	Eukaryota
Kingdom	Fungi
Phylum	Deuteromycotina
Class	Hyphomycetes
Other Names	-
Distribution	Sabah (Ellis MB, 1971; Singh KG, 1980)
Status	Non-pathogenic to pineapple.
Biology, Ecology & Morphology	Colonies on natural substrata green, brown or black, usually with sparse, floccose superficial mycelium and abundant sporulation. Setae and hyphopodia are absent. Conidia nearly always in chains and less than 10u long. Conidia narrowly fusiform often with dark median band (Ellis MB, 1971).
Affected Plant Stages	No information.
Affected Plant Parts	No information.
Symptoms	No information.
Damage	No information.
Host	On dead plants especially common on herbaceous stems (Ellis MB, 1971)
Control	-
References	<ol style="list-style-type: none"> 1. Ellis MB, 1971. <i>Dematiaceous Hyphomycetes</i>. Commonwealth Mycological Institute (CMI) : 517-519 2. Hawksworth DL, Sutton BC, Ainsworth GC, 1983. <i>Dictionary of The Fungi 7th Edition</i>. p165, 191 3. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9

18.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Hendersonula toruloidea</i> Nattrass
Common name	Hendersonula fruit rot, leaf spot
Domain	Eukaryota
Kingdom	Fungi
Phylum	-
Class	Coleomycetes
Other Names	<i>Exosporina fawcetti</i> Wilson <i>Torula dimidiata</i> Penz. <i>Scytalidium dimidiatum</i> (Penz.) B. Sutton & Dyko [anamorph] <i>Nattrassia mangiferae</i> (Syd. & P. Syd.) B. Sutton & Dyko (preferred name)
Distribution	Peninsular Malaysia: Meru, Klang 1979; Fruit; (Lim WH, 1985) Peninsular Malaysia; Leaf spot; (Singh KG, 1980)
Status	No information
Biology, Ecology & Morphology	<p>Mycelium floccose, initially light grey becoming black with age and fast growing. Pycnidia dark and separate. Conidiophores long and flexuous. Conidia often extruded in cirri, initially one-celled, hyaline to light yellow, later becoming three-celled and dark. Produced torula stage (Lim WH, 1985).</p> <p><i>Fruit</i> The disease appeared to be more serious in plots that had not been fertilized. The fungus is a wound parasite and is commonly associated with fruitlets that were damaged by sunscorch. Inoculation studies confirmed that infection could not occur via open flowers or on wound-inoculated young fruits. However, fruits approaching maturity gradually succumbed to infection when wound-inoculated. Fungus is a common saprophyte of dying or dead pineapple tissues (Lim WH, 1985).</p> <p><i>Leaf</i> No information.</p>
Affected Plant Stages	Fruiting stage.
Affected Plant Parts	Fruit and leaves.
Symptoms	<p><i>Fruit</i> One to a few fruitlets are observed to turn yellow prematurely. The fruit may become distorted, bending towards the side of infection. On cutting the fruit, a brown to black firm rot of the flesh is seen. Within the lesion, a mat of grey mycelium can be seen lining the locular cavities of the infected fruitlet. The rot is not restricted to the fruitlet and may enlarge to infect the adjacent flesh extending to the core. No distinctive odour is associated with the rot. Only fruits close to maturity are affected (Lim WH, 1985).</p> <p><i>Leaves</i> No information.</p>
Damage	The unusual fruit rot of Mauritius pineapple was observed in a farm in Meru, Klang in 1979. About 20% of fruits in the area were infected. Subsequent to that observation the disease was occasionally observed in other areas on cv. Mauritius as well as on Masmerah and Hybrid 1 (Lim WH, 1985).
Hosts	<i>Ananas comosus</i> , <i>Arachnis</i> sp., <i>Furcraea gigantean</i> , <i>Ipomoea batatas</i> , <i>Hevea brasiliensis</i> (Singh KG, 1980)

Control	<p><i>Cultural</i></p> <ol style="list-style-type: none"> 1. Ensure pineapple plots are adequately fertilized. 2. Severe sunscorching can be reduced by intercropping pineapples (in the case of cv. Mauritius) with oil palm or coconut (Lim WH, 1985).
References	<ol style="list-style-type: none"> 1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International, 2002. 2. Lim WH, 1985. <i>Diseases and Disorders of Pineapples in Peninsular Malaysia</i>. Malaysian Agricultural Research and Development Institute (MARDI) Report, 97:19. 3. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 220 4. Sutton BC, 1980. <i>The Coelomycetes- Fungi Imperfecti with Pycnidia Acervuli and Stromata</i>. Commonwealth Mycological Institute. p347.

19.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Macrophomina phaseoli</i> (Maubl.) Ashby
Common name	-
Domain	Eukaryota
Kingdom	Fungi
Phylum	-
Class	Coelomycetes
Other Names	-
Distribution	Peninsular Malaysia ; leaves (Singh KG, 1980)
Status	No information.
Biology, Ecology & Morphology	Conidiomata are 100-200 μ m in diameter with the conidiogenous cells 5-13 x 4-6 μ m. Conidia are 14-30 x 5-10 μ m. Sclerotia are 50-300 μ m in diameter (Sutton BC, 1980).
Affected Plant Stages	No information.
Affected Plant Parts	Leaves.
Symptoms	No information.
Damage	No information.
Hosts	<i>Ananas comosus</i> , <i>Camellia sinensis</i> , <i>Coffea liberica</i> , <i>Derris elliptica</i> , <i>Elaeis guineensis</i> , <i>Eugenia caryophyllata</i> , <i>Hevea brasiliensis</i> , <i>Piper nigrum</i> , <i>Sesamun indicum</i> (Singh KG, 1980).
Control	-
References	<ol style="list-style-type: none"> 1. Hawksworth DL, Sutton BC, Ainsworth GC, 1983. <i>Dictionary of The Fungi 7th Edition</i>. p87, 228 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 222 3. Sutton BC, 1980. <i>The Coelomycetes- Fungi Imperfecti with Pycnidia Acervuli and Stromata</i>. p391-392.

20.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Marasmiellus scandens</i> (Massee) Denis & D.A. Reid
Common name	Thread blight, white thread blight
Domain	Eukaryota
Kingdom	Fungi
Phylum	Basidiomycota
Class	Basidiomycetes
Order	Agaricales
Family	Marasmiaceae
Other Names	<i>Marasmius byssicola</i> Petch <i>Marasmius scandens</i> Massee
Distribution	Sarawak ; (Singh, 1980)
Status	No information
Biology, Ecology & Morphology	No information.
Affected Plant Stages	No information.
Affected Plant Parts	No information.
Symptoms	No information.
Damage	No information.
Hosts	Primary hosts: <i>Theobroma cacao</i> (cocoa). Secondary hosts: <i>Artocarpus integer</i> (jack tree), <i>Ananas comosus</i> (pineapple) , <i>Averrhoa carambola</i> (carambola), <i>Bambusa</i> , <i>Bougainvillea</i> , <i>Camellia sinensis</i> (tea), <i>Coffea arabica</i> (arabica coffee), <i>Coffea canephora</i> (robusta coffee), <i>Coffea liberica</i> (Liberian coffee tree), <i>Durio zibethinus</i> (durian), <i>Garcinia mangostana</i> (mangosteen), <i>Hevea brasiliensis</i> (rubber), <i>Ixora</i> , <i>Mangifera foetida</i> (bachang), <i>Mangifera indica</i> (mango), <i>Mangifera odorata</i> , <i>Metroxylon sagu</i> (sago palm), <i>Musa paradisiaca</i> (plantain), <i>Nephelium lappaceum</i> (rambutan), <i>Persea americana</i> (avocado), <i>Piper nigrum</i> (black pepper), <i>Psidium cattleianum</i> (strawberry guava), <i>Syzygium malaccense</i> (malay-apple), (CABI, 2002).
Control	No information.
References	1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i> . CAB International, 2002. 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i> , Ministry of Agriculture : 8-9

21.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Marasmius crinis-equi</i> F. Muell. ex Kalchbr.
Common name	Horse hair blight
Domain	Eukaryota
Kingdom	Fungi
Phylum	Basidiomycota
Class	Basidiomycetes
Order	Agaricales
Family	Marasmiaceae
Other Names	<i>Androsaceus crinis-equi</i> (F. Muell. ex Kalchbr.) Overeem <i>Marasmius equicrinis</i> F. Muell. ex Berk. <i>Marasmius graminium</i> var. <i>equicrinis</i> (F. Muell. ex Berk.) Dennis <i>Marasmius repens</i> Henn. <i>Marasmius trichorhizus</i> Speg.
Distribution	Sarawak ; Leaves; (Singh KG,1980)
Status	No information
Biology, Ecology & Morphology	No information
Affected Plant Stages	No information
Affected Plant Parts	Leaves
Symptoms	No information
Damage	No information
Hosts	Primary hosts: <i>Theobroma cacao</i> (cocoa), <i>Hevea brasiliensis</i> (rubber), <i>Leucaena leucocephala</i> (horse tamarind). Secondary hosts: <i>Artocarpus integer</i> (jack tree), <i>Ananas comosus</i> (pineapple) , <i>Bambusa</i> , <i>Camellia sinensis</i> (tea), <i>Citrus maxima</i> (pummelo), <i>Citrus nobilis</i> (tangor), <i>Cinnamomum verum</i> (cinnamon), <i>Derris elliptica</i> (Tuba root), <i>Garcinia mangostana</i> (mangosteen), <i>Ixora</i> , <i>Mangifera indica</i> (mango), <i>Mangifera odorata</i> , <i>Nephelium lappaceum</i> (rambutan), <i>Piper nigrum</i> (black pepper), <i>Psidium cattleianum</i> (strawberry guava) (CABI, 2002).
Control	<i>Cultural</i> M. crinis-equi can be adequately controlled through regular rounds of sanitation, clearing and removal of infected plants (CABI, 2002).
References	1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i> . CAB International, 2002. 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i> , Ministry of Agriculture : 8-9, 208

22.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Marasmius palmivorus</i> Sharples
Common name	Chlorosis, fruitlet brown rot (Singh KG, 1980)
Domain	Eukaryota
Kingdom	Fungi
Phylum	Basidiomycota
Class	Basidiomycetes
Order	Agaricales
Family	Marasmiaceae
Other Names	-
Distribution	Peninsular Malaysia ; Fruit; (Singh, 1980)
Status	No information.
Biology, Ecology & Morphology	Cultures of <i>M. palmivorus</i> are white to pinkish-white; no fructifications are formed on agar cultures. The rhizomorphs usually form fan-shaped mycelial mats; these are white, but sometimes pinkish-white (usually under drier conditions). Fructifications in the form of basidiomata develop from the rhizomorphs. These are cream to pinkish-white, and their size is often related to water availability. Under wet conditions, basidiocarps are produced in abundance and the cap (pileus) can reach 5-6 cm diameter; the caps are generally 1-3 cm diameter. Rows of white gills can be seen on the underside of the cap. The caps are usually tough, thin, slightly sulcate and the margin is entire and incurved; they shrivel in dry weather, but revive when moistened. The stipe is about 10 x 1.2 mm, but this can vary proportionally with the size of the caps as affected by water availability; is central, cylindrical but narrowly hollow, bulbous at the base, and whitish (CABI, 2002).
Affected Plant Stages	No information.
Affected Plant Parts	Fruits.
Symptoms	No information.
Damage	No information.
Hosts	Primary hosts: <i>Ananas comosus</i> (pineapple) , <i>Cocos nucifera</i> (coconut), <i>Elaeis guineensis</i> (African oil palm), <i>Hevea brasiliensis</i> (rubber), <i>Musa paradisiaca</i> (plantain) (CABI, 2002).
Control	<i>No information.</i>
References	<ol style="list-style-type: none"> 1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International, 2002. 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9

23.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Paecilomyces elegans</i> (Corda) Mason & Hughes
Common name	Basal leaf rot
Domain	Eukaryota
Kingdom	Fungi
Phylum	-
Class	Hyphomycetes
Other Names	-
Distribution	Peninsular Malaysia ; Leaves; (Singh KG, 1980)
Status	No information.
Biology, Ecology & Morphology	No information.
Affected Plant Stages	No information
Affected Plant Parts	Leaves.
Symptom	No information
Damage	No information
Host	<i>Ananas comosus</i> (Singh KG,1980)
Control	<i>No information.</i>
References	<ol style="list-style-type: none"> 1. Hawksworth DL, Sutton BC, Ainsworth GC, 1983. <i>Dictionary of The Fungi 7th Edition.</i> p275 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 231

24.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Phomopsis</i> sp.
Common name	-
Domain	Eukaryota
Kingdom	Fungi
Phylum	'Mitosporic fungi' (Anamorphic fungi)
Other Names	-
Distribution	Sabah, Sarawak; Leaves; (Singh KG, 2002)
Status	No information.
Biology, Ecology & Morphology	Pycnidia are dark, ostiolate, immersed, erumpent, nearly globose. Conidiophores are simple . Conidia are hyaline, 1-celled, ovoid to fusoid (alpha) conidia, and filiform, curved or bent stylospores (beta conidia) (Barnett HL, Hunter BB, 1972).
Affected Plant Stages	No information.
Affected Plant Parts	Leaves.
Symptoms	No information.
Damage	No information.
Hosts	<i>Agave</i> sp., Ananas comosus , <i>Cajanus cajan</i> , <i>Cinchona ledgeriana</i> , <i>Coffea canephora</i> , <i>Corchorus capsularia</i> , <i>Durio zibethinus</i> , <i>Erythrina subumbrans</i> , <i>Glycine max</i> , <i>Nephelium lappaceum</i> , <i>Psidium guajava</i> , <i>Pseudotsuga wilsoniana</i> , <i>Pyrus malus</i> (Singh KG, 1980).
Control	No information.
References	<ol style="list-style-type: none"> 1. Barnett HL, Hunter BB, 1972. <i>Illustrated Genera of Imperfect Fungi</i>, 3rd Edition. p168. 2. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International, 2002. 3. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 236

25.0 DISEASE FACT SHEET (PINEAPPLE)

<i>Species name</i>	Pineapple wilt-associated virus
Common name	Pineapple mealybug wilt (PMBW)
Virus Group	Virus
Family	Closteroviridae
Genus	Closterovirus
Other names	Pineapple mealybug wilt-associated closterovirus Ullman et al.,1989 pineapple wilt-associated closterovirus
Distribution	Peninsular Malaysia : widespread (CABI, 2002), Penang (Lim WH, 1985), Sabah: widespread, Sarawak: widespread ; Leaves, roots, fruits/pods; (CABI, 2002).
Status	Major-wilt incidence of 0.4% to 7.6% for Masmerah cultivars
Biology, Ecology & Morphology	<p>A virus was isolated from wilt-affected pineapple plants. The virus was filamentous, not enveloped, usually flexuous and 1200-1500 nm in length. The virus particles, when stained with saturated uranyl formate in methanol, showed an open structure of coat protein subunits characteristic of a closterovirus (CABI, 2002)</p> <p><i>Transmission</i> The circumstances resulting in epidemics are complex, involving multi-trophic interaction between mealybugs (<i>Dysmicoccus brevipes</i> and <i>D. neobrevipes</i>), ants, mealybug predators and parasites, virus, pineapple plants and other plant species such as <i>Agavae americana</i>, a host for mealybugs, and other wild grasses including <i>Paspalum</i>. Symptom expression also depends on the environmental conditions and variation of mealybug populations (CABI, 2002). In Peninsular Malaysia, only <i>Dysmicoccus brevipes</i> (bisexual) is found which is well distributed throughout the country (Lim WH, 1985)</p> <p>Mealybug populations are usually associated with ants. Ants tending mealybugs protect them from predation and remove the honeydew produced by the mealybugs, preventing the development of sooty mould, a fungal disease that causes high mortality in mealybug populations. The number of mealybug-infested pineapple plants and the number of ants in a field are correlated (CABI, 2002). Therefore, control of ants should also be done in order to control the mealybug wilt.</p> <p>The association of a virus and mealybug wilt symptoms suggest that the virus(es) is/are transmitted via mealybugs feeding on pineapple plants. Several reports have been published on the presence of another flexuous, rod-shaped virus and a bacilliform virus as a mixed infection a of clostero-type virus. It is possible that since pineapples are propagated vegetatively, a mild strain of virus may be perpetuating among clones of varieties. The secondary virus may be introduced via mealybugs and, by acting synergistically, cause wilt symptoms (CABI, 2002).</p>
Affected Plant Stages	Flowering stage, fruiting stage, seedling stage, and vegetative growing stage.
Affected Plant Parts	Leaves, roots, and fruits/pods.

Symptoms	<p>Sarawak cultivar being more resistant to mealybug wilt exhibits mild discolouration of leaves whilst Masmerah cultivar leaves turn to a bright red colour when infected with the virus.</p> <p>In Masmerah cultivar, the first indication of mealybug wilt is the yellow to red colouration of the leaf tips which would then spread down the leaf towards the base. At later stage these leaves curve downwards and eventually turn a dark dull red, loose their turgidity, flex backwards at the middle and wither at the tips. Roots of infected plants become stunted and eventually rot. Green spots can be found on leaves fed upon by the mealybugs (Lim WH, 1985).</p> <p>Plants affected at early stage of growth become stunted, do not produce fruits or sometimes produce small fruits (Lim WH, 1985; CABI, 2002)</p>
Damage	<p>Severely infested plants become stunted and may eventually wilt. Fruits produced are small unmarketable fruits and unsuitable for canning . Wilt incidence of the Masmerah cultivars ranges from 0.4% to 7.6% (Lim WH, 1985).</p>
Hosts	<p>Primary host: Ananas comosus (pineapple) (CABI, 2002)</p> <p>Secondary hosts :<i>Agavae Americana</i>, <i>Andropogon insularis</i> and <i>Paspalum urvillei</i> (CABI, 2002)</p>
Control	<p><u>Chemical</u></p> <ol style="list-style-type: none"> 1. Pre-plant insecticidal dip – planting materials are briefly immersed into insecticides before planting. 2. Spray insecticides at the heart of plant in areas with high population of mealybugs. 3. Spray insecticides to the ground especially the sides of the field to kill ants at three to four months interval. 4. Remove wilted plants as well as the surrounding healthy plants then spray the affected area with insecticides (Lim WH, 1985)
References	<ol style="list-style-type: none"> 1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International. 2. Lim WH, 1985. <i>Diseases and Disorders of Pineapples in Peninsular Malaysia</i>. Malaysian Agricultural Research and Development Institut (MARDI) Report, 97:25-30

26.0 DISEASE FACT SHEET (PINEAPPLE)

<i>Species name</i>	<i>Pseudomonas ananas</i> (Takimoto 1920) Young et al. 1978
Common name	Marbled fruit disease, fruitlet brown rot, fruitlet black rot, bacterial fruitlet rot
Domain	Bacteria
Phylum	Proteobacteria
Class	Gammaproteobacteria
Order	Pseudomonadales
Family	Pseudomonadaceae
Other names	<i>Pseudomonas syringae</i> pv. <i>antirrhini</i> (Takimoto 1920) Young et al. 1978 <i>Bacterium antirrhini</i> (Takimoto) Elliot 1930 <i>Phytomonas antirrhini</i> (Takimoto) Magrou 1937 <i>Pseudomonas antirrhini</i> Takimoto 1920 <i>Pseudomonas fluorescens</i> var. <i>antirrhinastris</i> Moffett 1966 <i>Xanthomonas antirrhini</i> (Takimoto) Dowson 1943
Distribution	Malaysia: present, no further details; fruit; (CABI, 2002)
Status	No information
Biology, Ecology & Morphology	The disease is spread by wind, rain and insects. The bacterium appeared to enter the fruit through the open flowers. The disease is most prevalent during warm weather especially on large succulent fruits which have relatively low acidity (Lim WH, 1985).
Affected Plant Stages	Fruiting stage
Affected Plant Parts	Fruits/pods.
Symptoms	At early stage, a tangential section of the fruit reveals brown discolouration of one or all three placental lobes of the fruitlets. Usually the rot is about 3 cm deep and does not extend beyond the base of one or more of the locules, however, sometimes the rot is extensive reaching to the core. The lesion is mottled bone brown (yellowish brown to dark brown) and is drier and harder than the surrounding healthy tissue, characteristically speckled or stippled against a whitish background. Solid masses of brown may occur in the fruitlet core. The discolouration is limited to the placental lobes although frequently the entire fruitlet is affected. In severely affected fruits, transverse sections show the diseased portions radiating around the core, giving a variegated appearance. The term marbled fruit was used to describe the disease because of the characteristic hardening of the tissues (Lim WH, 1985).
Damage	In Malaysia, the disease was rarely encountered in which not more than one percent of the fruits the cannery were affected by the disease. The disease was found to be common on Hybrid 1 pineapples and could be a potential serious problem of the cultivar where losses of more than 40% having been recorded. The disease had also been observed to cause heavy losses on the Gandul, a low fruit-acid cultivar (Lim WH, 1985).
Hosts	Primary hosts: <i>Ananas comosus</i> (pineapple) , <i>Antirrhinum majus</i> (snapdragon), <i>Penstemon</i> (CABI, 2002; Singh KG, 1980)

<p>Control</p>	<p><u>Cultural</u></p> <ol style="list-style-type: none"> 1. Increase the planting density to reduce fruit size since smaller fruits have higher acid content thus less prone to infection (Lim WH, 1985) <p><u>Chemical</u></p> <ol style="list-style-type: none"> 2. Increase the fruit acidity by applying potassium sulphate (Lim WH, 1985)
<p>References</p>	<ol style="list-style-type: none"> 1. CABI, 2002. <i>Crop Protection Compendium 2002 Edition</i>. CAB International. 2. Lim WH, 1985. <i>Diseases and Disorders of Pineapples in Peninsular Malaysia</i>. Malaysian Agricultural Research and Development Institut (MARDI) Report, 97:12-14 3. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 256

27.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Stachylidium bicolor</i> Link ex Fr.
Common name	-
Domain	Eukaryota
Kingdom	Fungi
Phylum	-
Class	Hyphomycetes
Other Names	-
Distribution	Sabah ; (Singh KG, 1980)
Status	Non-pathogenic to pineapple.
Biology, Ecology & Morphology	Conidiophores are up to 700µm long, 4-7 µm thick at the base, 2.5-4 µm at the apex. Phialides are smooth or minutely verruculose, hyaline or pale olivaceous, 9-20 x 3-4 µm. Conidia are 4-8 x 2-3 µm (Ellis MB, 1971).
Hosts	On dead stems, twigs, etc. of plants including <i>Allium, Ananas, Bambusa, Dioscorea, Gardenia, Heliconia, Heracleum, Hibiscus, Manihot, Musa, Oenanthe, Petasites, Phoenix, Populus, Pteridium, Sambucus, Solanum, Sporobolus, Theobroma, Urtica and Zea</i> (Ellis MB, 1971)
Control	-
References	<ol style="list-style-type: none"> 1. Ellis MB, 1971. <i>Dematiaceous Hyphomycetes</i>. Commonwealth Mycological Institute (CMI) : 538-539 2. Hawksworth DL, Sutton BC, Ainsworth GC, 1983. <i>Dictionary of The Fungi 7th Edition</i>. p364. 3. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9

28.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Stilbella proliferans</i> F.L. Stevens
Common name	-
Domain	Eukaryota
Kingdom	Fungi
Phylum	Ascomycota
Class	Ascomycetes
Order	Hypocreales
Family	-
Other Names	-
Distribution	Sabah ; Leaves; (Singh KG, 1980)
Status	No information.
Biology, Ecology & Morphology	No information.
Affected Plant Stages	No information.
Affected Plant Parts	Leaves.
Symptoms	No information.
Damage	No information.
Hosts	<i>Ananas comosus</i> , <i>Carica papaya</i> , <i>Theobroma cacao</i> (Singh KG, 1980)
Control	No information.
References	<ol style="list-style-type: none"> 1. Kirk PM, Cannon PF, David JC, Stalpers JA, 2001. <i>Dictionary of The Fungi, 9th Edition</i>. CAB International : 249, 487, 505 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 208

29.0 DISEASE FACT SHEET (PINEAPPLE)

Species name	<i>Stomiopeltis</i> sp.
Common name	Sooty mould (Singh KG, 1980)
Domain	Eukaryota
Kingdom	Fungi
Phylum	Ascomycota
Class	Ascomycetes
Order	-
Family	Micropeltidaceae
Other Names	No information.
Distribution	Peninsular Malaysia ; (Singh KG, 1980)
Status	No information
Biology, Ecology & Morphology	No information.
Affected Plant Stages	No information.
Affected Plant Parts	No information.
Symptoms	No information.
Damage	No information.
Hosts	<i>Ananas comosus</i> , <i>Persea gratissima</i> , <i>Theobroma cacao</i> (Singh KG, 1980)
Control	No information.
References	<ol style="list-style-type: none"> 1. Kirk PM, Cannon PF, David JC, Stalpers JA, 2001. <i>Dictionary of The Fungi, 9th Edition</i>. CAB International : 165, 321, 506 2. Singh KG, 1980. <i>A Check List of Host and Disease in Malaysia</i>, Ministry of Agriculture : 8-9, 250