Epidemi Penyakit Hutan

(Epiphytologi)

Proses Penyakit terjadi pada individu inang dan di dalam hutan merupakan fenomena normal dalam populasi/ekosistem

Dalam praktek masalah penyakit dalam hutan terjadi pada skala populasi

Epidemiologi (Epiphytologi)

- Ilmu penyakit dalam populasi
- Kajian perkembangan dan penyebaran pathogen
- Kajian faktor-faktor yang pengaruhi

Kondisi epidemi

- Perkembangan meluas dan merusak penyakit dalam komunitas
- Terjadi peningkatan individu-individu pohon yang sakit secara terus menerus

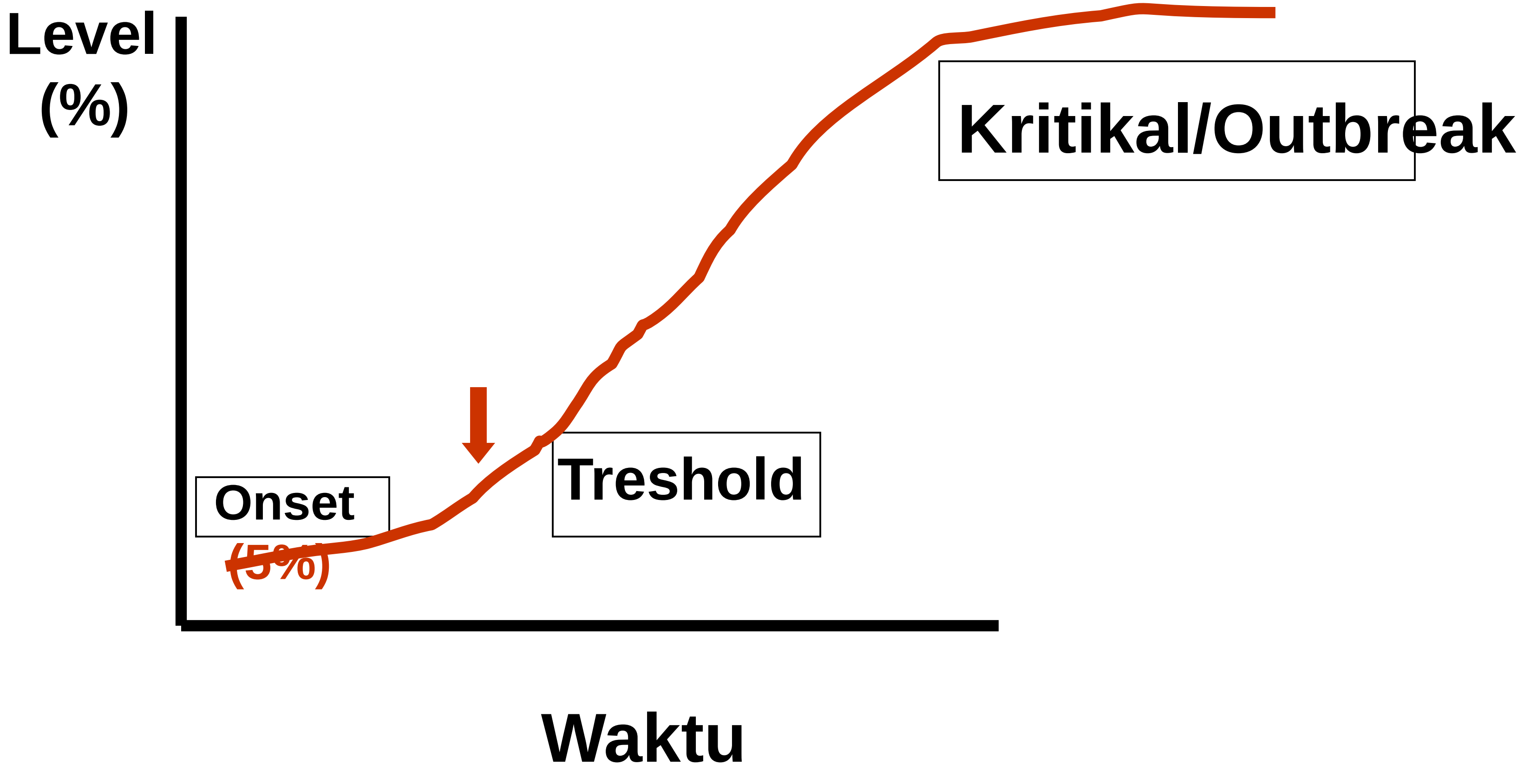
Laju Penyebaran ditentukan oleh:

- **Sifat pathogen**
- **Tumbuhan inang**
- **Faktor-faktor lingkungan**

Mekanisme Penyebaran Epidemi

- **Peningkatan infeksi secara terus menerus**
- **Pada jarak yang semakin lebar dari titik pusat awal**
- **Meningkat sampai proporsi yang berikan peluang menyebar secara masif**

Level Epidemi Penyakit Hutan



Peluang Epidemi

Ditentukan oleh :

- **Kapasitas reproduksi patogen**
- **Jumlah dan distribusi inokulum awal**
- **Kelimpahan tumbhan inang**

Kapasitas Reproduksi Patogen

Ditentukan oleh :

- **Kelimpahan inokulum**
- **Laju reproduktivitas patogen**

Laju Reproduktivitas Patogen

Ditentukan oleh waktu regenerasi (mulai kontak inokulum dengan jaringan inang sampai produksi dan pelepasan inokulum baru)

Penyakit yang disebabkan oleh patogen yang siklus multi tersebar lebih cepat dibanding yang bersiklus tunggal

Kapasitas penyebaran patogen yang perlukan inang pengganti untuk satu siklus dibatasi oleh persyaratan itu

Patogen yangmempunyai tipe spora lebih dari satu (jamur karat) mempunyai potensi epidemi tinggi

Infeksi lokal

- **Yang disebabkan oleh patogen yang tumbuh lambat atau sikliu reproduktif panjang, tidak dapat capai tk epidemik dalam satu musim**

- **Yang disebabkan oleh patogen aktif dengan reproduksi melimpah, menginfeksi inang yang sama dapat capai tk epidemi dalam satu musim**

Infeksi sistemik

- **Multiplikasi patogen agak lambat**

- **Waktu perkembangan patogen dalam inang adalah sama dengan waktu untuk menempati seluruh bagian inang**

Jumlah, ukuran dan distribusi inokulum primer

- Jumlah inokulum yang banyak dan terdistrubisi merata menimbulkan banyak titik pusat penyebaran lokal dan penyebaran ke areal lain

- Inokulum yang sedikit dan tersebar meluas akan membatasi penyebaran lokal dan perkembangan mencapai level *onset*

Jarak penyebaran

- Viabilitas inokulum dan agen penyebaran menentukan jarak penyebaran pathogen
- Patogen infeksi lokal menyebarkan inokulum pada jarak pendek
- Patogen yang punya lebih dari satu tipe inoculum dapat menyebar jauh

Ukuran dan distribusi inang

- Pertanaman satu jenis yang luas sebabkan penyebaran inokulum cepat

- Pertanaman campur atau dengan isolasi menghambat penyebaran inokulum

Kondisi pertanaman yang mendukung perkembangan epidemi

- Penanaman rapat tanaman/semai

- Kondisi keharaan/lingkungan yang terbatas

- Pertanaman satu jenis

- Tidak ada penebangan sanitasi/penjarangan

- Banyak sisa kayu tebangan tertinggal di lapangan

- Sisa kayu terinfeksi tidak dibersihkan dari lapangan

Problematik Penyakit Hutan

Benih dan Persemaian :

Busuk benih (*Penecillium, Aspergilus, Trichoderma, Rhizo[pus*)
Damping-off (*Phytium, Fusarium, Rhizoctonia*)
Busuk akar (*Sclerotium rolfsii*)
Nematoda (*Meloidogyne*)
Karat daun (*Pestalotia* sp, *Phyllachora* sp)
Embun jelaga (*Microsphaera, Erysiphe, Sphaerotera*)

Tanaman :

Karat tumor pada sengon
Kanker batang (*Corticium salmonicolor, Pellicullaria salmonicolor*)
Busuk akar (*Ganoderma* sp dll.)
Defisiensi hara
Karat daun (*Pestalotia* sp, *Phyllachora* sp)

Logged-over areas

Busuk kayu : saprofit fakultatif

Lumber

Busuk kayu (busuk basah, busuk coklat, busuk putih)
Buluk (Bluestain,

southern pine beetle outbreak on the Sam Houston National Forest in Texas, produce forest conditions that have all the ingredients leading to a fast-moving, high-intensity catastrophic wildland fire

Endemic, the normal disease situation in a defined location or place. This means the normal incidence of infectious diseases such as hepatitis, or influenza, or salmonellosis, etc..

Epidemic, an outbreak, an increase above normal epidemic levels. Epidemic might be a few cases, if there are none normally, or currently. It might be a dozen, a hundred, or several thousand.

Pandemic, disease spreading, or threatening to spread, throughout the globe, covering the entire planet. The epidemic flu of 1918–1919 was a true pandemic. AIDS is a pandemic.

Some factors that could be considered when determining whether an epidemic exists include:

- Current population levels relative to endemic levels
- Observed rates and extent of population increase and/or spread
- Species composition of the stand
- The age and size of the trees in the stand
- Stand densities or stocking levels
- Climate and seasonal weather patterns
- Disturbance events such as wind, snow, and ice storms, fire

- **Insect or disease epidemics result from vulnerable stand conditions (*hazard*, see the Glossary) and increasing pest populations (*risk*, see the *Glossary*).**

- **An understanding of implications of a particular outbreak will come from an evaluation of the interaction of species, forest conditions, and weather-related phenomena, such as extended periods of drought and high winds.**

Factors to consider when evaluating the threat that insect or disease epidemics pose to ecosystem components or forest or rangeland resources include:

- **Forest and stand conditions**
- **Pest populations and their rate of increase or decrease**
- **Weather-related conditions such as drought**
- **Fire**
- **Tree damage from a variety of causes**

To be sure, not all examples of disease progress can be as neatly categorized as these, but in general plant disease epidemics tend to be either roughly linear or exponential in the early stages, and they tend to level off as they approach some limit.

The impact of plant disease and the losses that it causes are a function of disease progress. To reduce this impact, we need not eliminate the disease, we merely need to keep disease development below an acceptable level. That means that the progress of disease and the factors that influence disease progress must be understood in quantitative terms.

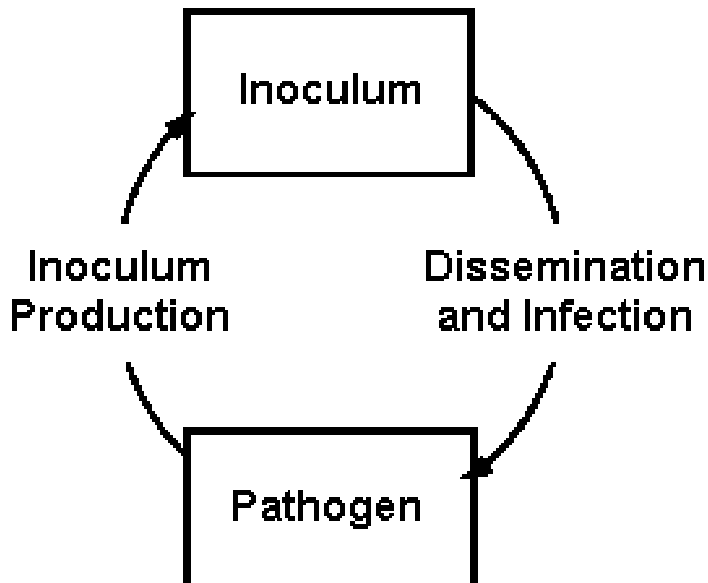
Disease Incidence (DI) = (n / N) x 100%
Disease Severity (DS) = $\{[(n_0 \times z_0) + (n_1 \times z_1) + \ldots + (n_5 \times z_5)] / (N \times Z)\} \times 100\%$

Where:

DI	= Disease incidence
DS	= Disease Severity
n	= Number of infected trees
n_0, n_1, n_2, n_3, n_4	= number of trees with index score 0, 1, 2, 3 and 4
z_0, z_1, z_2, z_3, z_4	= index score of gall rust presence 0, 1, 2, 3, and 4
N	= Total number of trees in one plot (10)
Z	= the highest score (4)

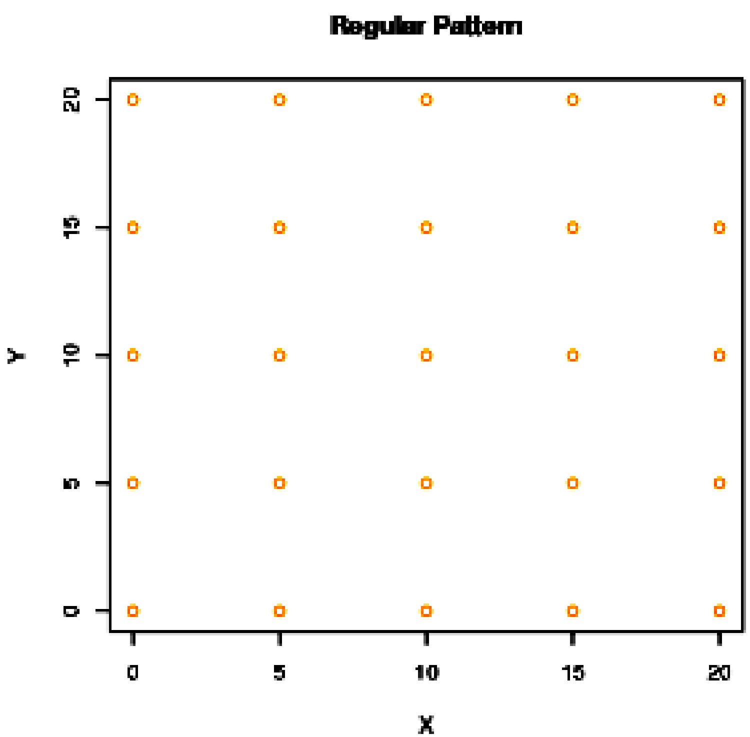
Plant disease epidemics are cyclical phenomena, that is, they consist of repeated cycles of pathogen development in relation to the host and the environment.

The inoculum, which might consist of fungal spores, bacterial cells, nematodes, viruses within an aphid vector, or some other propagules of a pathogen, gains entry into and establishment within the host tissues through the process of infection.

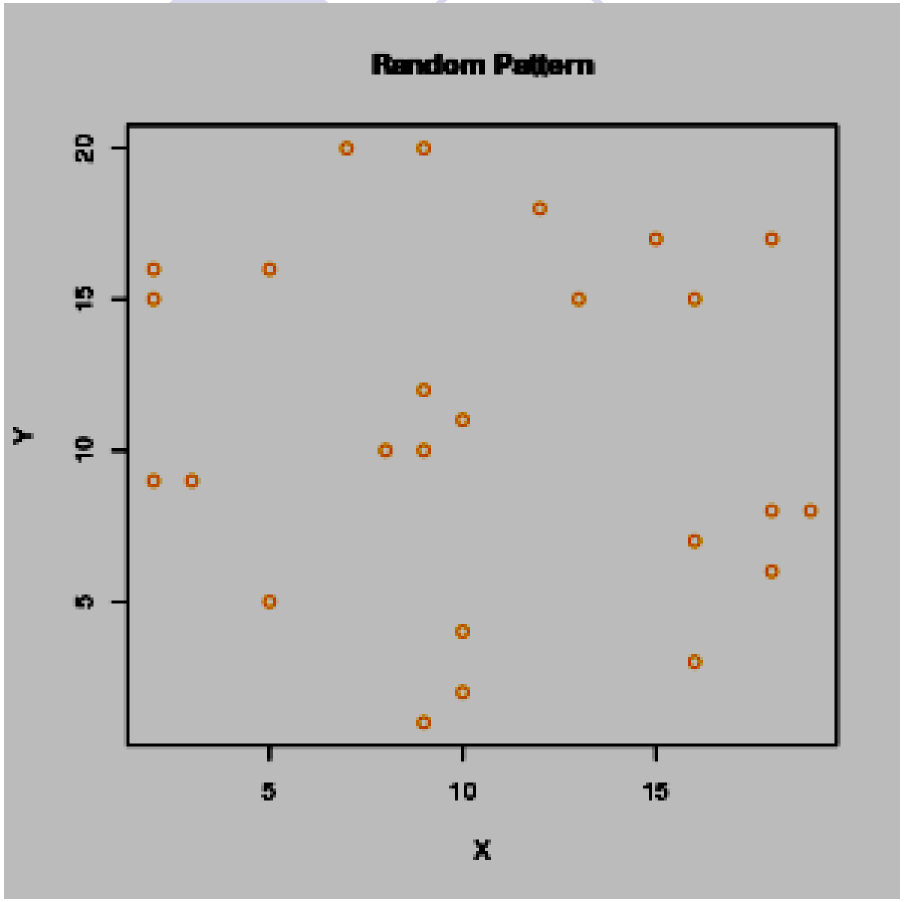


Disease Distribution

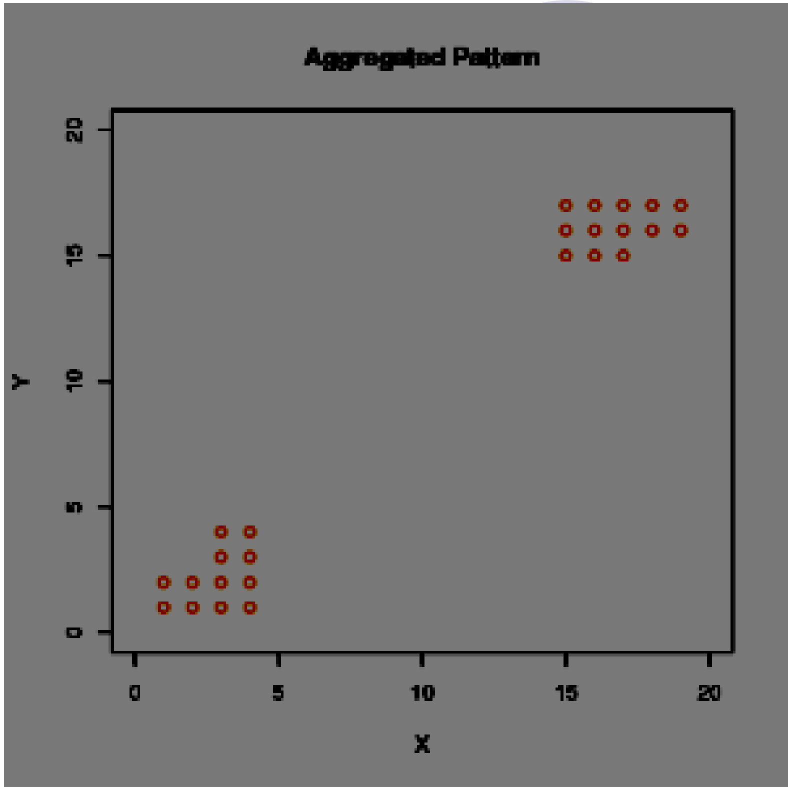
Spatial Analysis (Penyakit berkembang dalam ruang secara vertikal maupun horisontal)




```
#Create a regular pattern plot with R, where every fifth tree is infected along a grid
x <- c(0,5,10,15,20,0,5,10,15,20,0,5,10,15,20,0,5,10,15,20,0,5,10,15,20)
y <- c(0,0,0,0,0,5,5,5,5,5,10,10,10,10,10,15,15,15,15,15,20,20,20,20,20)
# An alternative method for creating these vectors is
x <- rep(c(0,5,10,15,20),5)
y <- sort(x)
# use help(rep) and help(order) to understand these commands better
plot(x, y,
    col='orange',
    xlab='X',
    ylab='Y',
    main='Regular Pattern',
    xlim=c(0,20),
    ylim=c(0,20))
```




```
# Create a random pattern illustration, where randomly selected trees are infected;
# Each realization is independent so yours will not appear exactly as pictured below.
x=rep(1:20,20)
y=rep(1:20,20)
xy=cbind(x,sort(y))
random.pattern=xy[sample(nrow(xy),25,replace=F),]
plot(random.pattern, xlab="X", ylab="Y", col="orange")
```



In this example of a highly aggregated pattern, all the infected trees are grouped into two clusters.

```
x=rep(1:2,2)
y=rep(1:2,2)
aggregated.pattern=cbind(x,sort(y))
x2=rep(3:4,4)
y2=rep(1:4,2)
aggregated.pattern2=cbind(x2,sort(y2))
x3=rep(15:17,3)
y3=rep(15:17,3)
aggregated.pattern3=cbind(x3,sort(y3))
x4=rep(18:19,2)
y4=rep(16:17,2)
aggregated.pattern4=cbind(x4,sort(y4))
plot(aggregated.pattern,
    xlab="X",
    ylab="Y",
    main="Aggregated Pattern",
    xlim=c(0,20),
    ylim=c(0,20),
    col="orange“)
points(aggregated.pattern2, col="orange")
points(aggregated.pattern3, col="orange")
points(aggregated.pattern4, col="orange")
```