RINGKASAN

PEMODELAN DAYA HAMA *Plutella xylostella* L.PADA TANAMAN KUBIS UNTUK MENENTUKAN SAAT PENGENDALIAN KIMIAWI

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Plutella xylostella Linneaus atau ulat daun kubis merupakan salah satu hama penting pada tanaman kubis. Hama ini termasuk serangga dengan metamorphose sempurna yaitu : telur, larva, pupa dan imago. Kubis merupakan tanaman yang memiliki nilai estetika; oleh karena itu kerusakan sedikit akibat adanya hama ini dapat menyebabkan kubis tidak layak jual. Tindakan pengendalian kimiawi dengan penyemprotan insektisida masih dianggap satu-satunya cara efektif untuk mengendalikan hama dan dilakukan atas data kualitatif, dilakukan secara terjadwal dengan interval 7 hari dan frekuensinya bertambah pada serangan hama tinggi. Namun cara tersebut tidak berhasil menekan populasi hama, karena dilakukan pada saat yang tidak tepat misalnya pada saat serangan hama rendah, pada saat laju daya hama rendah atau mungkin karena insektisida diberikan dengan dosis tinggi. Akibatnya banyak dampak negatip yang ditimbulkan diantaranya resistensi hama, resurgensi dan berbahaya bagi kesehatan manusia.

Untuk mengurangi dampak negatip tersebut telah disosialisasikan tentang program Pengendalian Hama Terpadu (PHT). Pada program tersebut penggunaan insektisida didasarkan atas ambang kendali 5 larva (kumulatif) instar 3-4 per 10 tanaman contoh, tanpa memperhatikan karakteristik individu larva Plutella.

Tujuan dari penelitian ini adalah menduga model daya hama setiap instar larva dan model umum bagi larva secara keseluruhan , mengetahui instar mana yang menimbulkan kerusakan paling besar dan bagaimana cara menentukan instar tersebut di lapang.

Berdasarkan diagram pencar kumulatif daya hama, model Logistic dengan 4 parameter A,B,C dan M digunakan untuk mem*fit* data daya hama setiap instar. A adalah limit bawah, B adalah 2 kali laju pertumbuhan relatif, C adalah daya hama potensial dan M adalah saat di mana laju daya hama absolut mencapai maksimum dan pada saat itu larva telah mengkonsumsi 50% dari daya hama potensial. Model Logistic berangkai dengan 16 parameter dibuat untuk menggambarkan model daya hama larva Plutella.Untuk pemulusan model, asimtot atas dari kurva Logistic 1 menjadi asimtot bawah kurva Logistic berikutnya secara berurut sehingga model memiliki 13 parameter.

Saat di mana larva mengalami pergantian kulit digunakan sebagai pembatas antar kurva. Metode interpolasi digunakan untuk menduga parameter model tersebut dan uji terhadap kesesuaian model dilakukan dengan melihat sebaran

sisaan dan koefisien determinasi serta membandingkannya dengan besaran yang sama pada model linier sederhana.

Model Logistic berangkai lebih sesuai dari pada model linier sederhana dan dari model Logistic berangkai diperoleh titik kritis yang terjadi pada 2 hari, 6 hari,10 hari dan 14 hari berturut-turut untuk instar 1, instar 2, instar 3 dan instar 4. Walaupun data diperoleh dari pengamatan berulang, tetapi pola sebaran sisaan secara grafis menunjukkan kebebasan antar pengamatan sehingga analisis ragam dapat digunakan untuk mengetahui perbedaan daya hama antar instar. Analisis klasifikasi dua arah bagi data daya hama pada kondisi lapang menunjukkan bahwa rata-rata daya hama tertinggi oleh instar 3 tetapi tidak menunjukkan perbedaan yang nyata dengan rata-rata daya hama instar 2. Rata-rata daya hama tertinggi diperoleh dari pengamatan pagi hari, tidak menunjukan perbedaan yang nyata dengan rata-rata daya hama pada pengamatan siang hari, namun berbeda dengan hasil pengamatan pada sore hari. Artinya kegiatan larva dalam mengkonsumsi daun tidak berbeda pada malam hari dan pagi hari.

Berdasarkan hasil tersebut maka dapat disimpulkan bahwa penyemprotan insektisida lebih tepat dilakukan pada hari ke 6 dan pada hari ke 10 sejak ditemukan larva yang baru keluar dari jaringan daun. Pada saat tersebut larva berada pada tahap instar 2 dan instar 3, dengan panjang larva tidak lebih dari 7 mm.

Model Logistic berangkai yang dihasilkan merupakan gambaran umum tentang daya hama Plutela pada tanaman kubis khususnya yang ditanam pada ketinggian 1500 dpl; diharapkan hasil penelitian ini dapat digunakan sebagai salah satu unsur dalam PHT yaitu sebagai salah satu dasar pertimbangan dalam memutuskan saat aplikasi pengendalian kimiawi.

SUMMARY

FOOD CONSUMPTION MODEL OF *Plutella xylostella* L. ON CABBAGE AS A BASIS IN DETERMINING THE TIME OF CHEMICAL CONTROL

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One of the important pest in cruciferous crops is *Plutella xylostella* L. (Diamondback Moth or Dbm). Dbm has 5 lifestages : egg, larvae, pupa, adult. Because the crop has an aesthetic values, damage caused by the Dbm larvae (most commonly called 'shotgun damage') made the yield to be unfit for sale. Until recently, the decision of whether to control that insect by spraying insecticide solely based on symptom or even weekly, because it is the only way to kill the insect effectively (known as Scheduled Application of Pesticide Method). Nevertheless, it was not succeed, because the action was often made at wrong time such as scheduled at low attack level or at the stage where the consumption rate is low, and sometimes the dose was over given. Due to the way of conduct this qualitative approach practice was inefficient besides many other negative effects such as pest resistance, resurgency and may harm the people's health.

The new approach called Integrated Pest Management had been developed and applied. It was based on action threshold which is 5 larva cumulative per 10 sampled plants, it means that someone just gathetered the larvae without knowing the characteristic of each of 4 stages (called instar) during the larval period.

The aim of the research was building a dbm larval consumption model for each instar and for the whole larva as well. Besides, it was important to understand which instar caused the most damage and how could we recognize that instar easily. The hypothesis to be tested were : food consumption of larva follows a Logistic curve (one of the biologically based curves), the consumption between instar is diffrerent significantly and we can determine such instar by looking at the larval body length.

There are 4 instars in larval stage so that based on the plot, the data set was fitted by 4 Logistic curve (called Combined Logistic) with 16 parameters. The general form of the Logistic model consist of 4 parameters : A is the lower limit, C is the upper limit, B is twice the Relative Consumption Rate (RCR) and M is time where Absolute Consumption Rate (ACR) is maximum, Relative Consumption Rate (RCR) has declined to ½ B and the larvae has eaten 50% of its consumption potential.

In order to make it smooth, the upper limit of i-th Logistic became the lower limit of Logistic (i+1) for i=1,2,3. So the Combined Logistic then consist of 13 parameters and each of Logistic curve is cut by the time they

molt. Using interpolation approach, the parameter of the model was adjusted until the Error Sum of Squares is minimized (convergence criterion method). This curve was better in fitting the data set than the linier one as the Error sum of Squares less than that of linier trend. Both of laboratory and field data set showed a same trend.

Initially, larvae eat very differently, and this sets the pattern of different C, different M, different B and different cut ages. Leaving the C_0 we did a test to know the liniearity each of the parameters. By building full model and reduced model in regression, we got a linear trend with 2 parameters. For the field data, B was approximately linear decline with increasing instar number, but not for the C and M. The M was found to be 2, 6, 10 and 14 days for instar 1, instar 2, instar 3 and instar 4 respectively.

Actually the data collected from repeated measurement is dependent. Take out the trend, what we were left with was independent random error so it was allowed to continue with analysis of variance. There was a significant difference in consumption and the time of observation. The mean of consumption of instar 2 and instar 3 was not significantly different but those showed a significant difference across the rest. In the time of observation, there was no significant difference between morning and day time, but significantly different with afternoon time. That is an indication that the activity in food consuming is greater at night and in the morning compare to day time.

The conclusion is that a chemical control by spraying insecticide is suggested to apply when there were larvae in instar 2 and instar 3, that is at least in day 6 and day 10 since the larvae coming out from the leaf tissue. Those stages can be determined by looking at larval body length that is less then 7 mm.

This result is very important for the decision maker as it is one of the basis to revise the action threshold under the Integrated Pest Management program.

ABSTRACT

FOOD CONSUMPTION MODEL OF *Plutella xylostella* L. ON CABBAGE AS A BASIS IN DETERMINING THE TIME OF CHEMICAL CONTROL

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Plutella xylostella L. (Diamondback Moth) is one of the important pest on cabbage crop ; the presence of the Plutella's larvae (caterpillar) caused the yield to be unfit for sale. There are 4 stages in larval stadium called instar 1, instar 2, instar 3 and instar 4. Based on the scatter plot, it was decided to use the Combined Logistic with 4 equations with 13 parameters to fit the larval food consumption. The M parameter of the Logistic curve play an important role as it is time which absolute consumption rate is maximum. Building a full model and reduced model in regression for the field data revealed the following results : M were found to be 2, 6, 10 and 14 days respectively for instar 1, 2, 3 and 4. There was no significant difference of food consumption between instar 2 and instar 3 but there is a significant difference between the time of observation. Based on the result it could be suggested that it was better apply the chemical control at day 6 and day 10 because the M of instar 2 and 3 occurred at 6 days and 10 days respectively since they coming up from the leaf tissue. Those instars could be determined by looking at the larval body length that was less than 7 mm. This food consumption pattern is assumed to be generally present in Plutella's larval stage, so that it can be used as one of the basis to revise the action threshold, which issaid that the threshold is 5 larvae instar 3 or 4 on 10 sampled plants.

Key words : *Plutella xylostella* L., instar, food consumption, Combined Logistic,critical point M, body length