RINGKASAN

HUBUNGAN POPULASI SERANGGA HAMA *Riptortus linearis* F. PADA BERBAGAI STADIA PERTUMBUHAN POLONG DENGAN KERUSAKAN POLONG DAN PENGARUHNYA TERHADAP HASIL KEDELAI (Glycine max (L.) Merriil.)

Kedelai (*Glycine max* (L.) Merrill) merupakan salah satu jenis tanaman kacang-kacangan yang penting di daerah tropis dan subtropis. Meskipun kedelai bukan merupakan komoditas strategis, namun tanaman ini dianggap penting dan sangat diperlukan oleh sebagian besar penduduk Indonesia, karena memiliki banyak manfaat, diantarnya sebagai bahan baku bahan makanan seperti tempe, tahu, taoco, dan bahan makanan lainnya.

Usaha yang dilakukan untuk meningkatkan produksi kedelai banyak menemui kendala dan salah satu faktor pembatas penting yang menyebabkan rendahnya produksi kedelai adalah serangan hama. Telah diketahui bahwa terdapat sembilan jenis hama utama yang menyebabkan kerusakan pada tanaman kedelai dan salah satunya adalah pengisap polong *Riptortus linearis F.*

Serangan hama *R. linearis* ini masih sering diabaikan dan dianggap kurang penting karena beberapa alasan, antara lain : (1) serangan hama ini tidak menunjukkan gejala yang mudah dilihat, (2) serangga dewasa amat aktif bergerak, akibatnya kerusakan pada polong kedelai baru disadari setelah panen. Serangan populasi *R. linearis* pada saat stadia pembentukan polong (R3-4) dan pengisian biji (R5-6) menyebabkan biji menjadi keriput, polong gugur dan serangan pada biji yang sudah tua (R7-8) dapat menurunkan kualitas biji kedelai.

Tindakan pengendalian untuk mengatasi serangan *R. linearis* dengan menggunakan insektisida kimia belum mampu menekan kehilangan hasil. Kegagalan pengendalian hama ini seringkali disebabkan karena kurangnya pemahaman terhadap sifat bioekologi serangga, seperti : (a) penentuan stadia hama yang paling merusak tanaman, (b) hubungan antara kepadatan populasi dengan kerusakan tanaman dan (c) hubungan antara kepadatan populasi hama dengan hasil tanaman.

Untuk kepentingan analisis pendugaan kehilangan hasil tanaman, para peneliti berusaha mengkuantitatifkan pengaruh populasi hama terhadap kerusakan tanaman dan hasil. Perkembangan ini telah mendorong para ahli untuk memformulasikan hubungan antara populasi hama dengan kerusakan tanaman, dan kehilangan hasil yang diakibatkan dengan menyusun model matematika.

Penelitian ini bertujuan untuk: (1) mengetahui pengaruh kepadatan populasi nimfa dan imago hama *R. linearis* terhadap kerusakan polong dan biji serta hasil kedelai pada berbagai stadia pertumbuhan polong (R3-4, R5-6, dan R7-8, (2) mengetahui pengaruh stadia nimfa dan imago pengisap polong *R. linearis* terhadap kerusakan polong dan biji serta hasil kedelai pada stadia R3-4, R5-6, dan R7-8; (3) mengetahui pengaruh kepekaan stadia pertumbuhan polong kedelai (R3-4, R5-6, dan R7-8) terhadap kerusakan polong dan biji serta hasil kedelai akibat inokulasi hama pengisap polong *R. linearis*; dan (4) menduga kerusakan polong kedelai berdasarkan persamaan matematika Teorema Pengangkutan Reynold pada berbagai stadia pertumbuhan polong R3-4, R5-6, dan

R7-8, dan (5) menduga bahwa kerusakan polong yang diperoleh dari hubungan populasi hama *R. linearis* dengan kerusakan polong yang diturunkan dari Teorema Pengangkutan Reynold dapat digunakan untuk memprediksi hasil kedelai pada berbagai stadia pertumbuhan polong R3-4, R5-6, dan R7-8.

Penelitian dilakukan melalui tiga tahap, tahap I, II, dan III menggunakan rancangan yang sama, yaitu Rancangan Acak Lengkap (RAL) yang terdiri dari sembilan macam perlakuan dan diulang tiga kali. Jenis perlakuan dimaksud adalah kepadatan populasi hama *R. linearis* yang terdiri atas : P0 = kontrol, P1 = infestasi 1 ekor nimfa, P2 = infestasi 2 ekor nimfa, P3 = infestasi 3 ekor nimfa, P4 = infestasi 4 ekor nimfa, P5 = infestasi 1 ekor imago, P6 = infestasi 2 ekor imago, P7 = infestasi 3 ekor imago, dan P8 = infestasi 4 ekor imago yang berperan sebagai variabel bebas. Variabel terikatnya meliputi : kerusakan polong, kerusakan biji, biomas basah polong dan biomas kering biji kedelai.

Untuk mengetahui hubungan antara kepadatan populasi dengan kerusakan polong kedelai dilakukan analisis model matematika melalui pendekatan teori Kontinum (Apsley, 2005). Dari hubungan fungsional antara masing-masing peubah tersebut, melalui pendekatan Teorema Pengangkutan Reynold kemudian dicari persamaan matematikanya untuk setiap stadia hama pada berbagai stadia pertumbuhan polong kedelai (R3-4, R5-6, dan R7-8).

Hasil penelitian menunjukkan bahwa : (1) Kepadatan populasi 4 ekor imago *R. linearis* pada stadia R3-4, R5-6, dan R7-8 menyebabkan kerusakan polong dan biji paling tinggi dan hasil kedelai paling rendah. Dengan demikian kehadiran populasi imago *R. linearis* sebelum mencapai 4 ekor di areal kedelai sudah harus mendapat perhatian sebelum mencapai ambang ekonomi (2) Stadia imago *R. linearis* mempunyai kemampuan merusak polong dan biji yang lebih besar sehingga menyebabkan hasil paling rendah dibanding dengan stadia nimfa. Dengan demikian imago hama ini menjadi perhatian dalam monitoring populasi dalam rangka implementasi PHT (3) Kerusakan polong dan biji paling tinggi serta hasil kedelai paling rendah didapatkan pada stadia R5-6 akibat inokulasi hama pengisap polong *R. linearis* (4) Hubungan populasi hama pengisap polong *R. linearis* dengan kerusakan polong kedelai dalam bentuk persamaan matematika Teorema Pengangkutan Reynold (TPR), dapat digunakan untuk memprediksi besarnya kerusakan polong pada stadia R3-4, R5-6, dan R7-8. Besarnya nilai simpangan pendugaan prediksi tersebut berturut-turut adalah : 0,00 – 1,74 persen, 0,06 – 0,45 persen dan 0,19 – 1,45 persen, dan (5) Hubungan populasi hama pengisap polong *R. linearis* dengan kerusakan polong dalam bentuk persamaan matematika TPR, dapat digunakan untuk memprediksi hasil kedelai pada stadia R3-4, R5-6, dan R7-8. Besarnya nilai simpangan pendugaan prediksi tersebut berturut-turut adalah : 0,017 – 0,25 persen, 0,027 – 0,086 persen dan 0,023 – 0,099 persen.

SUMMARY

THE RELATIONSHIP BETWEEN POPULATION OF POD SUCKING BUGS *Riptortus linearis* F. AND THE DAMAGE OF SOYBEAN POD ON VARIOUS OF POD GROWTH STAGES AND ITS INFLUENCE TO THE SOYBEAN YIELD

Soybean is an important legume crops in the tropic and sub-tropic area. Even though soybean is not a strategic commodity, it is an important plant and demanded as daily food by Indonesian society as stock feed of fermented soybean (tempe), coagulated soybean (tahu) and other soybean food products.

There are many obstacles to increase the soybean products, and one of the obstacles which causes the lower soybean production is the pest attack. There are nine kinds of the main pest causing damage to the soybean, one of them is the pod sucking bug *Riptortus linearis* F.

The species is assumed not the important pest due some reasons : (1) the symptoms are invisible, (2) the adult insect more active and the damage were clearly detected after harvest. The attacks of pod sucking bug *R. linearis* on pod developing stage (R3-4) and the seed filling stage (R5-6) cause the seed crinkles, and pod abortion and on the seed ripening stage (R7-8) the damage will affect to the seed quality.

The use of insecticides to control the pod sucking bug does not effectively suppress the yield loss. Factors affecting to the effectiveness are : (1) to determine the most damaging stage of pest toward the plant, (2) The relationship between population density and plant damage, and (3) The relationship between pest population and yield.

For predicting the loss yield analysis, some researchers have tried to quantify the effect of pod sucking bug *R. linearis* population to the damage and yield. The effort has encouraged to make relationship formulation among population, damage, and yield in the form of mathematic model.

The aims of this research are : (a) to know the effect of density of pod sucking bug population on various of pod growth stages to the soybean pod damage and yield, (b) to know the effect of nymph and adult stages of pod sucking bug *R. linearis* to the soybean pod damage and yield on various of pod growth stages, (c) to know the effect of sensitivity of soybean pod stages (R3-4, R5-6, and R7-8) to the soybean pod damage and yield caused by pod sucking bug *R. linearis,* (d) to predict the damage of soybean pod based on the Reynolds Transport Theorem mathematical equation on the various of pod growth stages (R3-4, R5-6, and R7-8) , (e) to predict the soybean yield based on the Reynolds Transport Theorem mathematical equation on the various of pod growth stages (R3-4, R5-6, and R7-8).

There are three steps of this research, all of the step use completely randomized design with nine treatments and each was replicated three times. The treatment were : P0 = control, P1 = infestation of 1 nymph, P2 = infestation of 2 nymphs, P3 = infestation of 3 nymphs, P4 = infestation of 4 nymphs, P5 = infestation 1 adult, P6 = infestation 2 adults, P7 = infestation 3 adults, and P8 = infestation 4 adults of *R. linearis*. The population density of pod sucking bug was the independent variable, while dependent variables were : the rate of pod damage, the rate of seed damage, the soybean yield.

Analysis of mathematical modeling was made by continuum theory approach (Apsley, 2005). Mathematic equation for an every pest stage and pod growth stage (R3-4, R5-6, and R7-8) were made by Reynolds Transport Theorem approach (Munson, *et al.,*, 1998).

The results showed that: (1) the population density of four adults of pod sucking bug on the various of pod growth stages (R3-4, R5-6, and R7-8) caused the highest pod and seed damage and caused the lowest soybean yield. Therefore, the existence of pod sucking bug adults *R. linearis* before the population reaching four adults in the soybean field, it should had been treated control action before the pod damage becoming more serious, (2) Adults of pod sucking bug *R. linearis* have the ability to damage bigger soybean pod and seed, so that it causes the decrease yield to the lowest compared with the nymph stadium on the various of pod growth stages (R3-4, R5-6, and R7-8). Therefore adults of pod sucking bug *R. linearis* become the center of attention in population monitoring in the soybean ecosystem, in the implementation of soybean Integrated Pest Control (3) The highest pod damage and the lowest yield were found in the pod filling seed stage (R5-6) as a result of *R. linearis* inoculation. It means that the seed filling stage (R5-6) is the most sensitive reproductive stage to the damage of soybean (4) Relationship between population of *R. linearis* and pod damages in the form of mathematical equation which is used to predict the soybean pod damage on the various of soybean pod growth stages (R3-4, R5-6, and R7-8) has errors such as : 0,00 – 1,74 percent; 0,06 – 0,45 percent, and 0,19 – 1,45 percent. Therefore, the mathematical equation can be used to predict soybean pod damage on the various of pod growth stages, and (5) Relationship between population of *R. linearis* and pod damages in the form of mathematical equation which is used to predict the soybean yield on the of various pod growth stages (R3-4, R5-6, and R7-8) has errors such as : 0,017 – 0,25 percent; 0,027 – 0,086 percent, and 0,023 – 0,099 percent. Therefore, the relationship between *R. linearis* population and the soybean pod damage in the form of mathematical equation can be used to predict soybean yield on the various of pod growth stages.

ABSTRACT

THE RELATIONSHIP BETWEEN POPULATION OF POD SUCKING BUGS *Riptortus linearis* F. AND THE DAMAGE OF SOYBEAN POD ON VARIOUS OF POD GROWTH STAGES AND ITS INFLUENCE TO THE SOYBEAN YIELD

The aims of this research are to know the effect of population density of pod sucking bug to the soybean damage, and to predict the damage of soybean pod and yield on various of pod growth stages through the relationship between population density of pod sucking bug *R. linearis* with pod damage where made by modification of Reynolds Transport Theorem.

There are three steps of this research, all of the step use completely randomized design with nine treatments and each was replicated three times. The treatment were : P0 = control, P1 = inoculation of 1 nymph, P2 = 2 nymphs, P3 = 3 nymphs, P4 = 4 nymphs, P5 = 1 adult, P6 = 2 adults, P7 = 3 adults, and P8 = 4 adults. The population density of pod sucking bug was the independent variable, while dependent variables were : rate of pod damage, rate of seed damage, dry pod weigh, and wet seed. Analysis of mathematical equation was made by approaching of Continuum Theory (Apsley, 2005) and Reynolds Transport Theorem (Munson, *et al.*, 1998).

The results showed that: (1) the population density of four adults of pod sucking bug on the various of pod growth stages (R3-4, R5-6, and R7-8) caused the highest pod and seed damage and caused the lowest soybean yield. (2) Adults of pod sucking bug *R. linearis* have the ability to damage bigger soybean pod and seed, so that it causes the decrease yield to the lowest compared with the nymph stadium on the various of pod growth stages. (3) The highest pod and seed damage and the lowest yield were found in the pod filling seed stage (R5-6) as a result of *R. linearis* inoculation. It means that the R5-6 stage is the most sensitive reproductive stage to the damage of soybean pod (4) mathematical equation which is used to predict the soybean pod damage on R3-4, R5-6, and R7-8 has errors such as : 0,00 – 1,74 percent; 0,06 – 0,45 percent, and 0,19 – 1,45 percent respectively. Therefore, the relationship between *R. linearis* population and the soybean pod damage in the form of Reynolds Transport Theorem mathematical equation can be used to predict soybean pod damage on the various of pod growth stages and (5) Mathematical equation which is used to predict the soybean yield on R3-4, R5-6, and R7-8 has errors such as : 0,017 – 0,25 percent; 0,027 – 0,086 percent, and 0,023 – 0,099 percent respectively.

Key words : Pod sucking bug *R. linearis*, population, pod growth stages, soybean yield