ECOLOGY AND BEHAVIOUR OF FRUIT FLY, *BACTROCERA PAPAYAE* IN PENINSULAR MALAYSIA

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ABSTRACT

Bactrocera (= *Dacus*) *papayae* bred from chillies collected from Klang (MARDI Station) and kept in laboratory cages, laid 5.6 eggs per female per day with a maximum of 34 eggs. The net egg hatchability was 46.2 % . Egg hatchability declined with age of females. The intrinsic rate of increase (r) was 0.1150 while the finite rate of increase (λ) was 1.13 .The net reproductive (R_o) was 170 female eggs per female, and generation time was 45 . The intrinsic rate of increase under laboratory conditions was similar to *Bactrocera* Malaysian A (bred from Star-fruit) and *B. cucurbitae* but higher than of *B. latifrons* .

Ovipositing females showed a distinct preference for riped fruits particularly, reddish orange colour over green chillies. Females seemed to be able to regulate egg laying according to availability of fruits. Hence the number of eggs laid per female was higher when exposed to 8 of chillies compared to 2,3 and 4 available chillies.

In a laboratory study on the suitability of fruits for larval development, 8 fruits species (papaya, guava, mango, banana, chilli, tomato, starfruit and eggplant) were selected to determine the fruits preferences as host. Papaya was the best preferenced fruit, It was found that peptone and yeast extract were the best diets for the fecundity and longevity .

The mean time (sec.) spent on oviposition activities of female upon arrival on a fruit were: 1) surface examining phase, 34 ± 3.2 (2) ovipositor probing and ovipositor insertion phase 192 ± 0.82 and (3) postoviposition phase11 ± 0.56,

Adults were compared for resistance to Malathion and Dichlorvous insecticies, the resistance to malathion 0.5×10^{-3} was higher than to dichlorvous 0.5×10^{-3}. Electrophoresis was used for enzyme esterase bands comprising the resistance and

susceptible strains, Carboxylesrterase (Car E) (3.1.1.1) detected at the adult stage. Both (α - β) naphthyl acetate was equally affective but β- naphthyl acetate was more affective and so suitable as substrate for esterase detection.

The strongest component of environment influencing the adult population of *B. papayae* was the availability of its favoured host fruits (papaya).

Theree major parasitoids of *B.papayae* in papaya were *Biosters vandenboschi, B. longicaudatus* and *B. arisanus*. Relationships between total initial hosts (*B.papayae* immatures) and total hosts killed by each parasitoid species good correlation and parasitoids relationships were not density dependent.

The percentage of the larvae that survived through fruits factors was 84.2% in soil, the soil factors reduced survival to 21.3 %. Amongst the soil factors, weather accounted for 45.5 % biotic factors 16.5 % and physical factors 2.5 % of the mortality. Predator ants (*Dolicholderus* and *Componotus* sp.) 19.1 %.

Three major components in the sexual behaviour included (1) Signal emission through male - wing fanning followed by arrival of females, (2) Courtship behaviour involving male - wing fanning followed by attempted copulations; and (3) Copulation. Further test also showed that females that had mated once were neither attracted to males nor accepted subsequent mating as readily as virgin females.

By modifying either the male's ability in emitting sexual signals, i.e. modification of wing fanning or the various sensory receptors in the females, i.e. the eyes for visual signals, the aristae for acoustic stimuli, and the antennae for olfactory cues, it was possible to investigate the separate modalities of sexual communication during the (1) attraction phase (i.e. the bringing together of the two sexes over a distance of 50 cm) and 2) courtship phase (i.e. signal emission at close range of about 5 cm). The wing fanning in males was found to play a significant role in the production of

signals for the attraction of and mating with females . Experiments conducted in the females showed that acoustic as well as olfactory signals were crucial in attracting females to wing fanning males, but only olfactory stimuli were important for mating acceptance of the females. Differential sexual success among males and female choice played an important role in the complex mating system in this species. Sexual success in males was measured in terms of ability to attract and mate with females. For the most part , both qualities could be found in the same male. It was also found that sexually successful males had the capacity of signalling for a longer duration, and had top rank in male-male aggressive interactions more frequently than males. Thus inter-male competition could possibly be another component of sexual selection operating in this species .

Abstrak

Bactrocera (= *Dacus*) *papayae* membiak di dalam buah cili yang dikumpul dari Klang (Stesyen MARDI) dan disimpan di dalam sangkar-sangkar makmal, menghasilkan 5.6 biji telur per betina per hari dengan maksimum 34 biji telur. Penetasan bersih telur ialah 46.2%. Penetasan telur menurun dengan umur betina. Kadar Penambahan Asas (r) adalah 0.115, sementara Kadar Penambahan Terbatas (λ) adalah 1.13. Pembiakan bersih (R_o) adalah 170 biji telur per betina dan generasi masa ialah 45. Kadar Penambahan Asas di dalam keadaan makmal adalah serupa dengan *Bactrocera* Malaysian A (membiak di dalam buah belimbing) dan *B. cucurbitae*, tetapi lebih tinggi daripada *B. latifrons*.

Betina penelur menunjukkan pemilihan jelas terhadap buah cili yang masak dan merah, warna jingga-kemerahan berbanding dengan hijau. Betina memperlihatkan keupayaan mengatur peneluran bergantung kepada kesediaan buah cili tersebut. Oleh itu, bilangan telur yang dihasilkan oleh seekor betina adalah tinggi setelah didedahkan dengan 8 pasang buah cili berbanding dengan 2, 3 dan 4 ekor betina.

Kesesuaian buah-buahan untuk perkembangan larva ditunjukkan seperti siri berikut: betik > jambu > mangga > tomato > belimbing > cili > pisang dan eggplant (tumbuhan penelur). Di dalam perumah betik adalah yang paling sesuai, berat dan saiz kepompong adalah 12.9g, 5.1mm dan kitaran hidupnya adalah 19.5 hari. Di dalam perumah eggplant (tumbuhan penelur) yang kurang sesuai, berat dan saiz kepompong adalah 4.5g, 3.1mm dan kitaran hidupnya adalah 23 hari.

Dewasa diberi makan dengan 4 jenis sajian iaitu pepton, ekstrak yis, kasein dan madu. Pepton dan ekstrak yis adalah sajian untuk serangga perosak untuk kesuburan dan kelanjutan usia.

Tempoh peneluran untuk berjaya atau tidak masing-masing puratanya adalah 192±3.2 dan 34±3.2. Aktiviti-aktiviti peneluran oleh betina sebaik sahaja singgah pada buah-buahan; 1) fasa pemeriksaan permukaan 2) fasa penerokaan ovipositor dan fasa penujahan ovipositor 3) fasa pasca-peneluran. Purata/min masa (saat) digunakan pada setiap fasa masing-masing 34±3.2, 192±0.82 dan 11±0.56.

Perbandingan daya ketahanan dewasa terhadap racun serangga, Malathion dan Dichlorvous,, di antara organofosfat yang telah diuji, ketahanan terhadap malathion 0.5 X 10^{-3} lebih tinggi berbanding dengan dichlorvous 0.5 X 10^{-3}. Elektroforesis telah digunakan untuk jenis-jenis enzim esterase yang merangkumi strain rintang dan strain rentan, Karboksilesterase (CarE) (3.1.1.1) dikesan pada peringkat dewasa. Kedua-dua (α–β) naftil asetat adalah sama berkesan tetapi β-naftil asetat lebih berkesan apabila digunakan sebagai substrat untuk pengesanan esterase.

Komponen persekitaran yang kuat mempengaruhi populasi *B. papayae* dewasa adalah kesediaan perumah buah-buahan yang sesuai. Dalam hal ini buah betik memainkan peranan yang penting.

Terdapat 3 jenis parasitoid yang penting bagi *B. papayae* di dalam buah betik iaitu *Biosteres vandenboschi, B. longicaudatus* dan *B. arisanus*. Perhubungan di antara jumlah mula perumah-perumah (*B. papayae* belum matang) dan jumlah perumah-perumah yang dibunuh oleh parasitoid setiap spesies adalah korelasi yang baik dan perhubungan parasitoid adalah kebergantungan kepada kepadatan.

81.9% larva di dalam buah betik terus hidup di dalam tanah, kematian semulajadi mengurangkan keterushidupan kepada 75.0%, sementara factor tanah mengurangkannya kepada 21.3%. Di kalangan faktor-faktor tanah yang menyebabkan kematian, faktor cuaca diambil kira iaitu 45.5%, faktor-faktor biotik

33.3% dan faktor-faktor fizikal 2.5%. Pemangsa seperti semut (*Lamponofus* sp., *Dolicholderus* sp. dan *Componotus* sp.) 18.9%.

Tiga (3) komponen penting di dalam kelakuan seksual termasuk 1) Penonjolan isyarat melalui jantan-sayap dikipaskan, diikuti oleh kedatangan betina-betina 2) Kelakuan pemikatan membabitkan jantan-sayap dikipaskan, diikuti oleh percubaan kopulasi dan 3) Kopulasi. Ujian seterusnya juga menunjukkan betina-betina telah berpasangan sekali sama ada tertarik kepada jantan-jantan atau menerima persanggamaan berikutnya sebagai betina-betina yang dara.

Dengan mengubahsuaikan sama ada keupayaan jantan di dalam menonjolkan isyarat-isyarat seksual iaitu pengubahsuaian kipasan sayap atau pelbagai deria penerima di dalam betina, iaitu mata untuk isyarat-isyarat visual/penglihatan, aristae untuk perangsang bunyi dan antenna untuk isyarat bau, ianya membolehkan penyiasatan modality perhubungan seksual berasing semasa 1) fasa tarikan (iaitu membawa 2 jantina yang berbeza bersama-sama pada jarak 50cm) dan 2) fasa pemikatan (iaitu penonjolan isyarat pada had yang dekat, lebih kurang 5cm). Kipasan sayap pada jantan ditemui memainkan peranaan penting di dalam isyarat pembiakan untuk menarik perhatian dan bersanggama dengan betina. Ujikaji dijalankan ke atas betina dan ianya menunjukkan bahawa isyarat bunyi dan bau sama penting untuk menarik betina kepada kipasan sayap jantan, tetapi hanya rangsangan bau penting untuk menerima pensanggamaan oleh betina. Perbezaan seksual di kalangan pemilihan jantan dan betina yang berjaya, memainkan peranaan yang penting di dalam system pensanggamaan yang kompleks untuk spesies ini. Kejayaan pensanggamaan di dalam jantan ditentukan dalam bentuk keupayaannya menarik dan bersanggama dengan betina. Dengan demikian persaingan jantan yang berbeza boleh jadi komponen lain di dalam operasi pemilihan seksual bagi spesies ini.

Abbreviation

Ali E.....Aliesterase

Ar E.....Aromatic esterase

Aryl E.....Arylesterase

^{0}C .....Centigrade

Car E.....Carboxylesterase

Ch E.....Colinesterase

cm.....centimetre

DDVP.....Dichlrovos

EDTA.....Ethylene Diamine Tetraacetic Acid

Fig. .....Figure

h.....hour

IBSEF.....Insititute of Biological Science Experimental Farm

M.....Molar

m.....meter

mm.....millimeter

RH.....Relative Humidity

Sec. .....Second

Sign. .....Significant

SIRM.....Sterile Insect Release Method

OP. .....Organophosphate

PO_4 buffer.....Phosphate buffer

UM.....University Malaya

UPM.....University Putra Malaysia

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