AGRIVITA VOLUME 34 No. 3 *OCTOBER - 2012* *ISSN : 0126-0537*

BIOLOGY OF *Trissolcus latisulcus* Crawford (Hymenoptera: Scelionidae), AN EGG PARASITOID OF *Chrysocoris javanus* Westw (Hemiptera: Scutelleridae)

D. Adidharma*) and Y.D. Ciptadi

Department of Plant Protection, Faculty of Agriculture, Bogor Agricultural University,
Jl. Kamper Kampus IPB Darmaga, Bogor, West Java Indonesia
*) Corresponding author Phone: +62-251-8629364 E-mail: dmyti@yahoo.co.id

Accepted: March 2, 2012/ Received: September 24, 2012

ABSTRACT

The biology of *Trissolcus latisulcus* Crawford was studied on eggs of *Chrysocoris javanus* Westw (Hemiptera: Scutelleridae) which is a serious pest of *Jatropha curcas* L.. The aim of this study was to investigate the biology of *Trissolcus latisulcus* as a basic knowledge for developing a more suitable biological control programme in controlling the pest *C. javanus*. The current laboratory study was designed to evaluate developmental duration from egg to adult of *C. javanus* under room condition temperature: 28.18 + 0.59°C and RH 56.33 + 4.27%. The results showed that the life cycle of immature *T.latisulcus* consisted of egg, larva (three instars), prepupa, pupa. The longevity period of each stadium was one day, four days, one day, and five days respectively. The development time from egg to adult took 12.66 ± 1.22 days for female and 11.91 ± 0.73 days for males.The life time from egg to dead adult was 17.40 ± 7.38 days for female and 23.70 ± 9.49 days for males. The egg of *T.latisulcus* was *stalked* type, the first instar larva was *teleaform* type and the third instar larva was *hymenopteriform* type.

Keywords: *Jatropha curcas* L, *Chrysocoris javanus* Westw*, Trissolcus latisulcus* Crawford, parasitoid eggs

INTRODUCTION

Jatropha curcas L, is particularly considered as one of the prospective plants for producing non-edible oil (Hambali , 2006). It is a toxic plant and can be used as an insecticide. However, it is deterrent for insects pest that cause economic damage in plantation (Rumini and Karmawati 2006).

C. javanus is one of important pests of *J. curcas* that attacks mainly on the growing fruits by sucking the fruits fluid so the crop yield completely falls down. The pest was previously included to the family Pentatomidae, but then this belonged to the Scutelleridae (Schuh and Slater, 1995). Synthetic chemical insecticides have been used satisfactorily to control this pest .However, it has caused resistance phenomena, very wide spread pollution and serious impact on ecosystems. To overcome these problems, biological control of *C. javanus* by using parasitoid such as *Anastatus* sp. (Hymenoptera : Eupelmidae), *Epiterobia* sp. (Hymenoptera: Pteromalidae) and *Trissolcus latisulcus* Crawford (Hymenoptera: Scelionidae) has been suggested by many authors (Rumini dan Karmawati, 2006; Qodir 2010). *T. latisulcus* is mostly found in the *J. curcas* plants, so that these parasitoids have a highly potential prospect to control *C. javanus*. However, the biological information of this parasitoid in eggs of *C. javanus* is rare .

The objective of this study was to investigate the biology of *T. latisulcus* in eggs of *C. javanus* as a basic knowledge for developing a more suitable biological control programme in controling the pest *C. Javanus*

MATERIALS AND METHODS

Chrysocoris javanus Westw

Stocks of *C. javanus* for laboratory cultures were initially collected from *J. curcas* crops in Leuwikopo, Darmaga and Lulut, Citeureup, located in Bogor, West Java, Indonesia. Individual leaves and branches of *J. curcas* that were infested by nymph and imago of *C. javanus* were collected and kept in sealable plastic bags and taken to the laboratory . *C. javanus* was reared in 45 cm x 45 cm x 60 cm wooden cages walled with gauze. The legs of

Accredited SK No.: 81/DIKTI/Kep/2011
http://dx.doi.org/10.17503/Agrivita-2012-34-3-p262-269

each cage were dipped in oil to avoid ants or other insects. Four-week *J.curcas* planted in 18 cm x 25 cm polybag was placed in the cages as food of *C. javanus.* The plants were watered in daily basis to keep them growing. The eggs of *C.javanus* were collected every day to be used in this experiment (Figure 1).

***Trissolcus latisulcus* Crawford**

Throughout the experiment, *T. latisulcus* came from a rearing facility at the Department of Plant Protection, Bogor Agricultural University. The parasitized eggs of *C .javanus* were collected from *J.curcas* crops and transferred into 0.5 cm x 10 cm test tubes covered with cotton ball. A pair of *T.latisulcus* which emerged from the eggs of *C. javanus* and had copulated was reared in test tubes fed with 20 eggs of *C. javanus* which were sticked on a 0.5 cm x 2 cm paper stub using Arabic gum. The parasitized eggs of *C. javanus* were collected and transferred into test tubes and kept under room condition of 28.18 + 0.59° C temperature and 56.33 + 4.27 % RH. Imago of *T.latisulcus* that emerged was used for this experiment (Figure 2).

Study on the biology and life cycle of *Trissolcus latisulcus* Crawford

Five one-day eggs of *C.javanus* were collected from mass rearing and sticked on 0.5 cm x 2 cm paper stub using Arabic gum. The eggs were placed in the test tubes, then a pair of *T. latisulcus* that had copulated was released and fed with 10% of honey. The tubes were placed on the wooden shelves supported by plastic pails to avoid the cultures from ants and other insects. This experiment was done in the laboratory under room condition of 28.18 $\pm$ 0.59 ^{o}C and 56.33 $\pm$ 4.27 % RH.

C.javanus parasitized eggs were dissected using micro needle and observed under a 40x stereo microscope. Dissecting was done every 24 hours to investigate the development of *T.latisulcus* from egg until pupa stadium. For investigation, the dissecting larva was done every 12 hours as the larva stage might be less than 24 hours. Observation was done to know the size, shape, color of each stadium of immature *T.latisulcus*. The life cycle of *T.latisulcus* was determined by the time from egg was laid to adult. The egg stadium was from egg laid to egg hatched, larvae stadium was from larva to pupa, pupa stadium was from pupa to adult. The life-time duration of adult was determined by the time from egg laid to the dead adult.

Figure 1. Mass rearing of *C.javanus* : (a) wooden cages (b) the eggs of *C.javanus* under the leaf of *J.curcas*

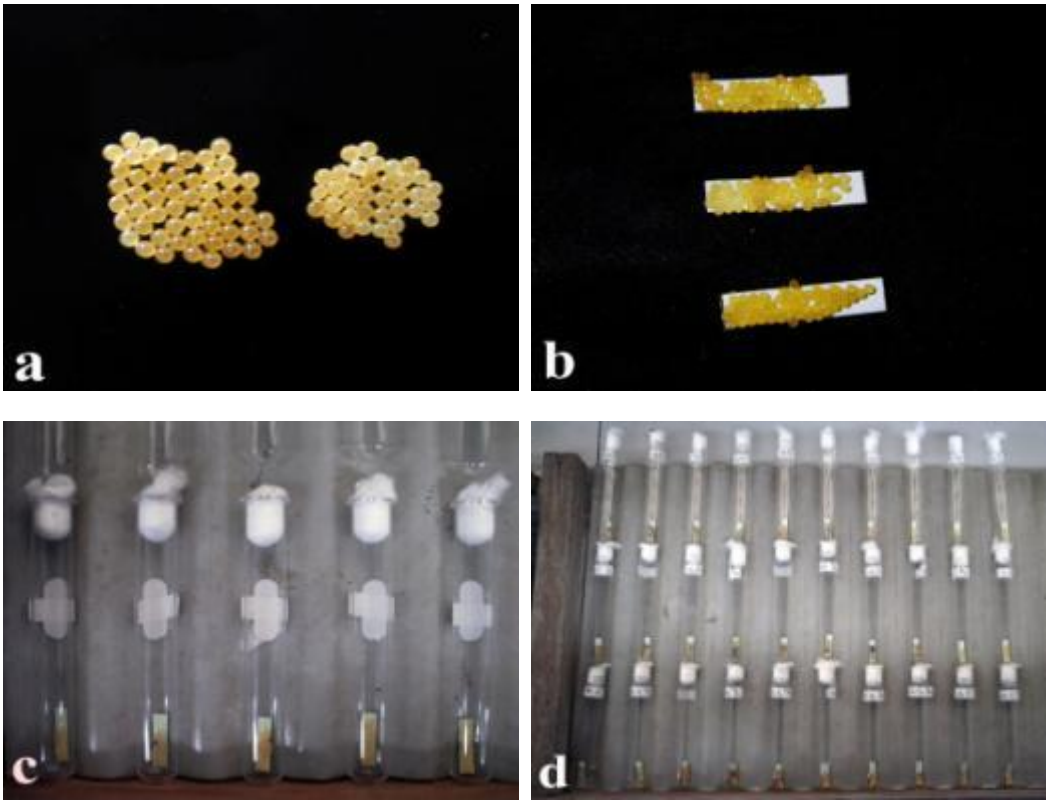

Figure 2. Rearing of *T.latisulcus* in laboratory (a). *C. javanus* eggs ; (b) Paper stub with *C. javanus* eggs ; (c) test tubes for *T.latisulcus* rearing ; (d) Parasitized eggs of *C. javanus*

RESULTS AND DISCUSSION

T. latisulcus is endoparasitoid soliter primer which is *idiobiont* and *hypermetamorfosis* type (Masner 1993, Austin *et al*., 2005). The life cycle of *T.latisulcus* consists of egg, larva, pre-pupa, pupa and imago.

Eggs

The shape of eggs *T.latisulcus* inside ovary was tapering (Fig. 3a), white, 0.25-0.34 mm in length and 0.05-0.12 mm in width. Inside the egg of *C.javanus*, *T. latisulcus* eggs had oval shape (Figure 3b) white, 0.35-0.43 mm in length and 0.15-0.2 mm in width. Both eggs had oval pointed stalk 0.14±0.01 mm in length named as stalked type (Figure 3) (Clausen, 1940). The egg stadium was one day.

Larvae

Larvae *T. latisulcus* occurred in the first day after the eggs were laid. Larvae had different shape and size for each instar and all instars developed inside their host until adult emergence. First instar larvae had abdomen with peer shape, white color and transparent, active, and had big mandible with hook shape towards the ventral (Figure 4a). The segment of larvae was not clear but was divided by two clear parts. The Mandible was on the *cephalothorax* (Noble and Kamal in Clausen, 1940). The first instar larvae were 0.37-0.85 mm in length and 0.14-0.57 mm in width, with 36 hour longevity. This type of larvae was named as *teleaform* (Clausen, 1940).

The second instar larvae was characterized by reducing mandible and its increasing size 0.85-1.23 mm in length (Figure 4b and 4c), circle shape, white color, and 60 hour longevity. The change of shape, color and size started 72 hours after the eggs were laid.

Figure 3. Eggs of *T.latisulcus* (a) inside the ovary, (b) 12 hours after the eggs were laid

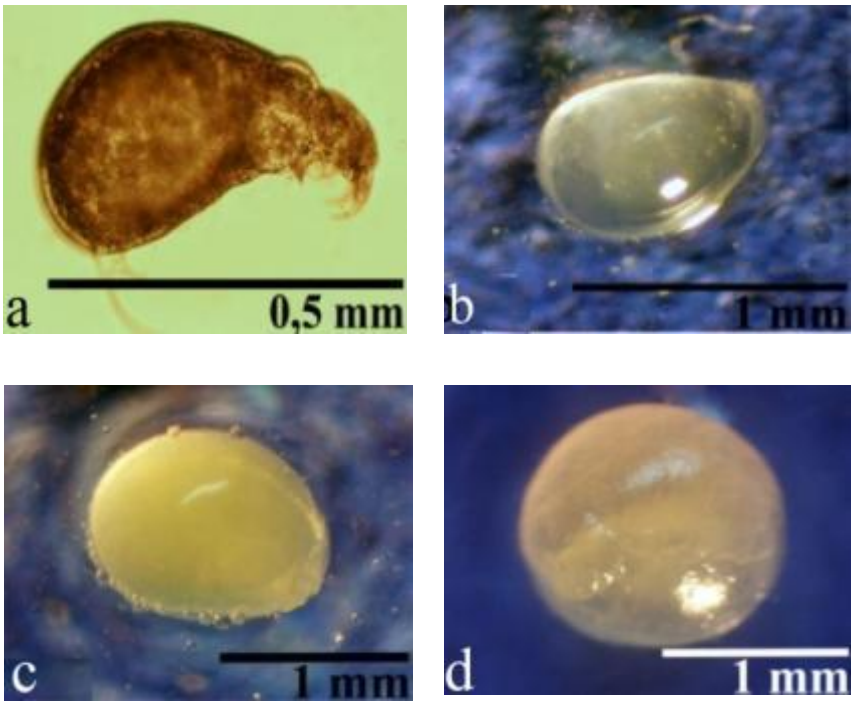

Figure 4. Larvae of *T.latisulcus*: (a) first- instar: 24 hours after the eggs were laid, mandible was clear ; (b) second instar: 60 hours after the eggs were laid, mandible was not clear ; (c) second instar : 72 hours after the eggs were laid, mandible was reduced ; (d) third instar: 108 hours after the eggs were laid .

The third instar larvae occurred 84 hours after the eggs were laid, round shape, yellowish-white color, mandible was reduced, the size was larger than the second instar larvae 1.25-1.46 mm in length and 1.00- 1.31 mm in width (Figure 4d) , 24 hours later the body was harding , the stadium of third instar larvae was 36 hours. The last instar larvae were *hymenopteriform* type (Hagen 1973). The stadium of larvae took 4 days.

Pre-Pupa

Pre-pupa occurred in 120 hours after the eggs were laid, yellowish-white color, segmented, 1.15-1.38 mm in length and 0.85-1.08 mm in width (Fig. 5). During the observation, larvae were entering *eonymph* phase which was likely to be the last instar larvae but the size was larger, more yellowish white in color (Morris 1937 *in* Hagen, 1973). The stadium of pre-pupae was 1 day.

Pupa

Pupa occurred in 144 hours after the eggs laid, milky-white in color, 1.31-1.38 mm in length, 0.80-0.85 mm in width non-active, eyes, legs, antenna, and segment were clearly distinguished (Figure 6a-c).

At 168 hours, the eyes of pupae *T. latisulcus* became reddish brown, 1.31-1.38 mm in length, 0.85-0.88 mm in width and the eyes, legs, and antenna were more clearly distinguished (Figure 6d-f). Pupae *T.latisulcus* became black at 192 hours, the color started to change from the head part toward thorax, 1.37-1.38 mm in length, 0.91-0.92 mm in width, (Figure 6g-i). At 216 hours, the abdomen of *T.latisulcus* became black, 1.37-1.40 mm in length, 0.91-0.92 mm in width. The legs and antenna were white and transparent, the wings were white, the eyes were reddish-black (Figure 6j-l). At 240 hours, the body of *T.latisulcus* became completely black, 1.45-1.46 mm in length, 0.69-0.71 mm in width. The eyes were black, and the femur, tibia and tarsus were light-brown; the wings were white, and had not completely grown (Figure 6m-o). The stadium of pupae was five days.

Imago

T.latisulcus emerged from the host by chewing the host skin-egg. Adult male and female *T.latisulcus* was black, while the femur, tibia and tarsus were light-brown (Figure 7). The adult male had round flagelomer, 1.33 $\pm$ 0.06 mm length and 0.69 $\pm$ 0.03 mm width, and was smaller than adult female: 1.51 $\pm$ 0.06 mm length and 0.73 $\pm$ 0.03 mm width. The developmental time of *T.latisulcus* from eggs to adult male was 11.91 $\pm$ 0.73 days and 12.66 $\pm$ 1.22 days for female.

Adult females *T.latisulcus* were mating immediately after emergence and then selected their eggs of *C.javanus* using antenna to lay eggs. According to Doutt *et al.* (1989) and Weber *et al.* (1996), such behaviour is intended to distinguish the host eggs whether they have been parasitized or not. This is to avoid the extinction due to superparasitism or multiparasitism. After selecting the appropriate host, adult female would do oviposition. For the eggs in the center of the group, oviposition was carried out on the top of eggs, and it was on the side wall section for the eggs which were the side of the group. *T.latisulcus* was also observed marking the parasitized eggs by touching its ovipositor on the eggs. Marking was made to resemble a figure eight pattern. The attached parasitized host's eggs by adult female is due to a *host marking pheromone* which is produced by the *Dufour* gland (Rosi *et al*. 2001). This behaviour was also observed in the spesies *T.latisulcus* used by Weber *et al.* (1996). The lifetime duration of adult male was 23.70 $\pm$ 9.49 days and adult female was 17.40 $\pm$ 7.38 days.

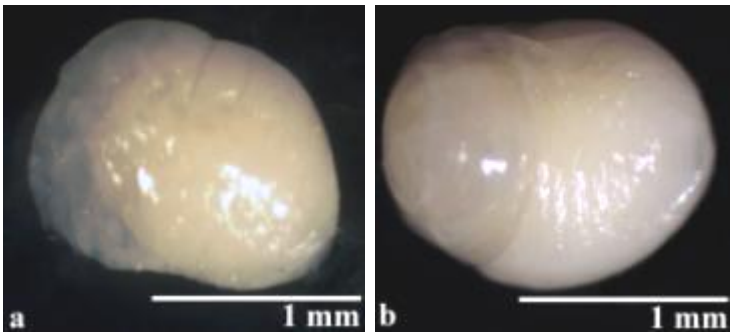

Figure 5 . Pre-pupae *T.latisulcus* : (a) lateral, (b) ventral.

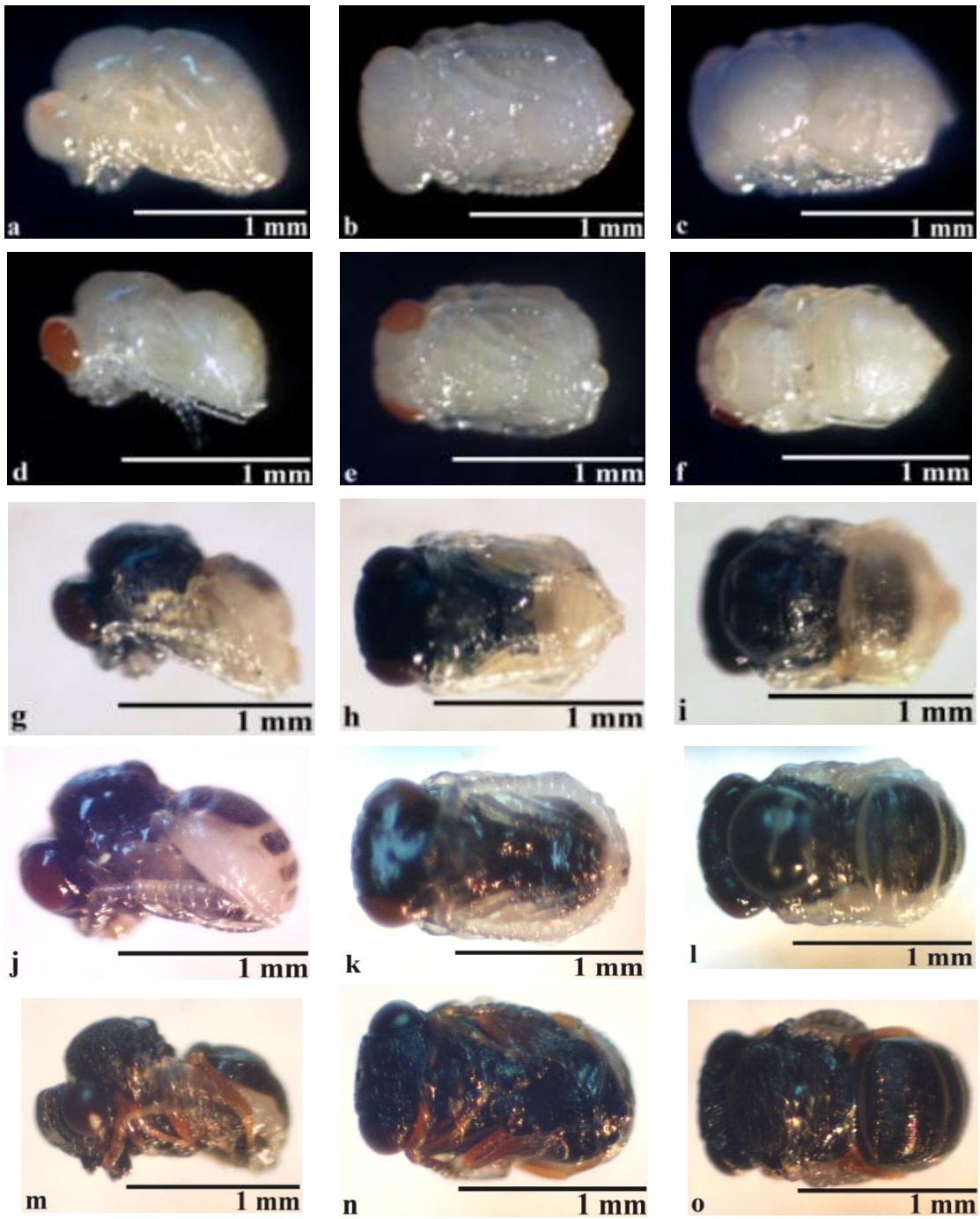

Figure 6. Pupae *T.latisulcus* 144 hours after the eggs were laid (a) lateral, (b) ventral, (c) dorsal;168 hours after the eggs were laid (d) lateral, (e) ventral, (f) dorsal; 192 hours after the eggs were laid (g) lateral, (h) ventral, (i) dorsal; 216 hours after the eggs were laid (j) lateral,(k) ventral, (l) dorsal; 240 hours after the eggs were laid (m) lateral, n) ventral, (o) dorsal.

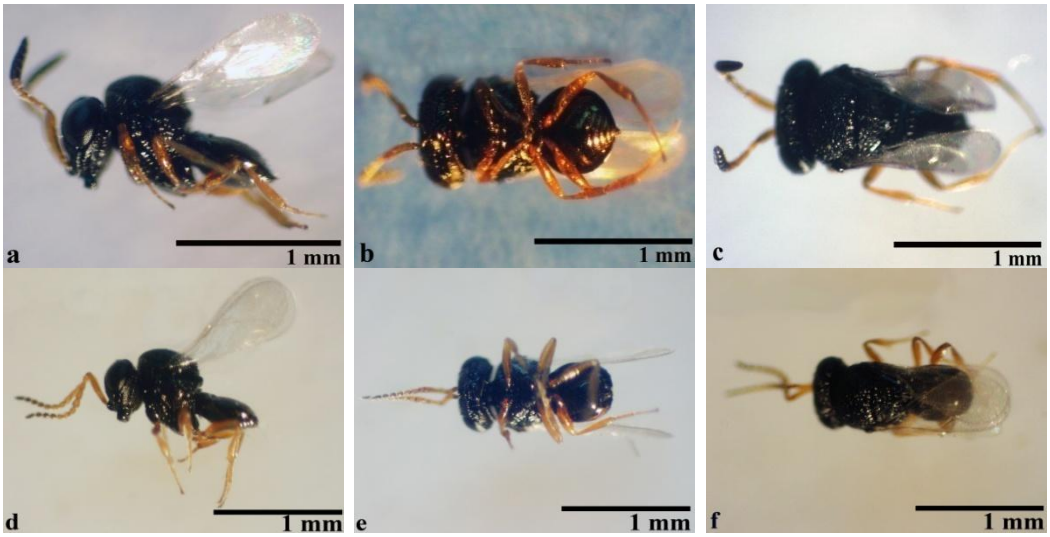

Figure 7. Imago *T.latisulcus.* Female (a) lateral, (b) ventral, (c) dorsal; male (d) lateral, (e) ventral, (f) dorsal

CONCLUSIONS

T. latisulcus is endoparasitoid soliter prime which is idiobiont and has hypermetamorphosis development. The developmental time of *T. latisulcus* from eggs to adult male was 11.91 ± 0.73 days and 12.66 ± 1.22 days for female. The life cycle of immature *T.latisulcus* consisted of egg, larva (three instars), prepupa, pupa. The longevity period of each stadium was one day, four days, one day, and five days respectively. The egg of *T.latisulcus* was ovate, creamy- white, *stalked* type, the first instar larva was *teleaform* type and the third instar larva was *hymenopteriform* type. The life-time duration of adult male was 23.70 ± 9.49 days and adult female was 17.40 ± 7.38 days.

REFERENCES

Austin, A.D., N.F. Johnson and M. Dowton. 2005. Systematics, evolution, and biology of scelionid and platygastrid wasps. Annu. Rev. Entomol 50: 553-582.

Clausen, C.P.1940. *Entomophagus insect*. New York: McGraw Hill Book Company Inc, page 250-257

Doutt, R.L., D.P. Annecke and E. Tremblay. 1989. Biologi dan hubungan hospes parasitoida. *In*: Huffaker CB, Messenger PS, editor. Teori dan praktek pengendalian biologis. Mangoendiharjo S, penerjemah. Untung K, pendamping. Jakarta: UI-press. Terjemahan dari: Theory and Practice of Biological Control.

Hagen, K. S. 1973. Developmental stages of parasites. *In*: DeBach P, Editor. *Biological control of insect pest and weeds*. London: Chapman and Hall Ltd. p.168-246.

Hambali, E. 2006. Kontribusi perguruan tinggi dan lembaga litbang untuk pengembangan jarak pagar (*Jatropha curcas* Linn*)* menjadi biodiesel dan minyak bakar. Dalam: Seminar Nasional Pengembangan Jarak Pagar (*Jatropha curcas* Linn) untuk Biodiesel dan Minyak Bakar. Prosiding. Bogor, 22 Desember 2006. Bogor. Pusat Penelitian Surfaktan dan Bioenergi. p.6-24

Masner, L. 1993. Superfamily Platygastroidea. *In*: H. Goulet and J.T. Huber Editor. Hymenoptera of the world: an Identification guide to families. Ottawa: Canada Communication Group. p.558-620.

Qodir, H.A. 2010. Pengamatan parasitoid telur pada *Chrysocoris javanus* Westw. (Hemiptera: Scutelleridae) di beberapa wilayah pertanaman jarak pagar (*Jatropha curcas* Linn.) di Kabupaten Bogor. [Unpublished M.Sc thesis]. Bogor: Fakultas Pertanian, Institut Pertanian Bogor. p. 27-29

Rosi, M.C., N. Isidoro, S. Colazza and F. Bin. 2001. Source of the host marking pheromone in the egg parasitoid *Trissolcus basalis* (Hymenoptera: Scelionidae). Journal of Insect Physiology 47: 989-995.

Rumini, W. and E. Karmawati. 2006. Hama pada tanaman jarak pagar (*Jatropha curcas*). In: Status teknologi tanaman jarak pagar (*Jatropha curcas* L.). Prosiding. Lokakarya II Jarak Pagar. 29 Nopember 2006, Bogor: Pusat Penelitian dan Pengembangan Perkebunan. p.302-306.

Schuh, R.T. and J.A. Slater. 1995. True bugs of the world (Hemiptera:Heteroptera).Classification and Natural History. Cornell University Press. pp.336.

Weber C.A.,J.M. Smilanick, L.E. Ehler and F.G. Zalom. 1996. Ovipositional behavior and host discrimination in three scelionid egg parasitoids of stink bugs. Biological Control 6: 245-252.