Effect of host diets on host preference and host suitability in *Telenomus* parasitoid (Hymenoptera: Scelionidae)

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Abstract

*Telenomus* sp. is one of the most important biological control agents for several Hemipterous and Lepidopterous insects. This study was performed to determine the effect of host diets on host preference and host suitability in *Telenomus* parasitoid. In this research, the hosts (*Nezara viridula*) was reared on the different diets, i.e. *Vigna sinensis*, *Phaseolus vulgaris*, and *Indigofera suffruticosa*. The result of this experiment showed that the parasitization level of *Telenomus* sp was not affected by host diets. However, host diets affected on the percentage of the parasitoid offspring. The percentage offspring was 96%, 81% and 44% from host fed on *I. suffruticosa*, *V. sinensis*, and *P. vulgaris*, respectively. The offspring for all of treatments was biased to female (more than 70%), however it was not affected by host diets. The developmental time for immature stage of *Telenomus* was also affected by host diets, it was 12, 13 dan 14 days from host fed on *I. suffruticosa*, *V. sinensis*, and *P. vulgaris*, respectively. These results indicated that *I. suffruticosa* more suitable host diet for the development of *Telenomus* progeny, which may due to more riches nutrients contain in this plant than the other plants.

Key words: Host Diets, Host Preference, Host Suitability, *Telenomus* sp., *Nezara viridula*, *Vigna sinensis*, *Phaseolus vulgaris*, *Indigofera suffruticosa*

Introduction

*Telenomus* sp. (Hymenoptera: Scelionidae) is one of the most important biological control agents for several Hemipterous and Lepidopterous insects. This parasitoid species is spread in all Indonesian archipelagous. One of the strategies to maintain population of the domestic natural enemies is by augmentation program.

The culturing of insect natural enemies and their hosts is complex. In the mass propagation process, there are two major concerns: (1) the availability of hosts in sustainable numbers (2) the development of techniques to assure maximum reproductive activity and optimum development and survival of the natural enemies (van den Bosch et al., 1982). On the other hand, van Driesche and Bellows (1996) stated that
natural enemies intended for augmentative purposes must be good quality and acceptable. To ensure production of natural enemies with good acceptable quality, several factors must be considered: genetics, nutrition, prevention of contamination, and provision of opportunities for exposure to appropriate host or prey semiochemicals and learning opportunities. Nutrition is a crucial factor in mass rearing of natural enemies because it can influence size, vigor, fecundity, and sex ratio of their offspring (van Driesche and Bellows, 1996; Thompson and Hagen, 1999).

Successful mass-rearing programs are also affected by host quality. There are many aspects related to host quality, e.g., host size, age, host diet, host condition, host species and host defenses (e.g., Vinson and Iwantsch, 1980; Godfray, 1994). All of these aspects influence host preference and host suitability of parasitoids (e.g., Vinson, 1976; Vinson and Iwantsch, 1980). In addition, Godfray (1994) described that three components of parasitoid fitness are influenced by host quality, as follow: (1) parasitoid survival until the adult stage; (2) parasitoid size and fecundity as an adult; and (3) parasitoid development time.

One of factors interact with host quality is host diet. Corrigan & Laing (1994) reported that host nutrition significantly affect on the development of *Trichogramma japonicum* parasitoid. There are no any report related to study the effect of host diets on the development of *Telenomus* progeny. In the present study the effects of host diets on the development of *Telenomus* progeny were observed.

**Materials and Methods**

**Insects**

*Telenomus* sp originally were collected from the fields in Banda Aceh and Aceh Besar districts. In the laboratory the adult parasitoid fed on 10% honey solution. In this research *N. viridula* eggs were used as host for Telenomus parasitoid. *N. viridula* were also collected from the field in Banda Aceh and Aceh Besar districts. In the laboratory, three groups of *N. viridula* fed on the different diets, i.e. Long bean (*Vigna sinensis*), French bean (*Phaseolus vulgaris*) and Guatemalan indigo (*Indigofera suffruticosa*). In this research, the second generation (F2) of host eggs were used as host.

**Host Preference and Host Suitability**

Twenty newly eggs of *N. viridula* of each groups (different diet) were glued on the manila paper and then were put into vial glass. An individual *Telenomus* female then was exposed to the host eggs to observe host preference (parasitization) level. There after, the parasitized host eggs were removed into the glass tube and kept until offspring emergence. The percentage progeny emergence, the developmental time of immature stage, and sex ratio of progeny were recorded.
Results and Discussion

The result showed that the parasitization level of Telenomus sp was not influenced by host diets (Fig. 1). Almost of host eggs were parasitized by Telenomus females, regardless of host diets. This result indicated that Telenomus females did not discriminated hosts of different diets. Unfortunately, in this experiment we did not exposed the females to the hosts in choice test. Under a choice test might be the females will be prefered to certain host.

On the other hand, the result showed that host diets affected on the percentage of the parasitoid offspring. The percentage offspring were 81%, 44% and 96% from host fed on long bean (V. sinensis), French bean (P. vulgaris), and Guatemalan indigo (I. suffruticosa), respectively (Fig. 2).

Hosts that were reared with I. suffruticosa produced higher percentage offspring than other hosts. This result indicated that N. viridula that were reared with I. suffruticosa is more suitable host for Telenomus parasitoid, because the host consumed higher quality diet than other hosts. Indigofera suffruticosa contain more riches nutrient, especially protein, rather than other host plants. The protein contain in 100 g weight of I. suffruticosa is 28% (Hassen et al., 2007), while in V. sinensis and P. vulgaris are only 17% and 2%, respectively (Dept. Pertanian, 1996 & Myujis, 2008).

Shaotang et al (1986) reported that in the field Telenomus parasitoid more common find searching hosts on Guatemalan bean rather than on other host plants. One of the crucial factor affect on succesful progeny production of insect parasitoids is the quality of host. The immature parasitoid progeny consumed suitable hosts growth healthier and more vigore than those consumed the unsuitable hosts. Shaotang et al. (1986) reported that the immature parasitoid progeny consumed poor quality hosts may not grow succesfully to adult progeny. The succesful of the development of parasitoid progeny inside a host depend on nutrition.
suitability, immunity system and competition (Vinson & Iwantsch, 1980). Schmidt (1994) reported that the number of parasitoid offspring emergence affected by the quantity and the quality of nutrition consumption during immature stage inside a host. The deficiency of essential nutrition during the immature stage, e.g. protein and carbohydrate may affect on mortality or the abnormality development of parasitoid progeny. The deficiency of nutrition sources influence on growth of parasitoid progeny and cell immun system. Host in poor condition contain reduced nutritional resources for the growing parasitoid, but may also have a weakened cellular defense system (Godfray, 1994).

Fig 1. Parasitism rates of *Telenomus* sp to hosts that were reared with different diets. No significant differences among the treatment.
The result also showed that host diets affect on the developmental time of immature stage of *Telenomus* progeny. The developmental time of the immature stage was shorter in hosts that were reared with *I. suffruticosa* than those were reared with *V. sinensis* and *P. vulgaris*. The developmental time of immature stage of Telenomus progeny were 12.3, 13.3 and 13.8 days from host fed on *I. suffruticosa*, *V. sinensis* and *P. vulgaris*, respectively. (Fig. 3).

Fig. 2. Relationship between host diets and adult *Telenomus* progeny emergence. Different letters above bars indicate significant differences among the treatments by LSD Test. (p<0.05)

![Graph showing the relationship between host diets and progeny emergence.](image)

**Fig 2.** The effect of host diets on the developmental time of immature progeny of *Telenomus* parasitoid. Different letters above
bars indicate significant differences among the treatments by LSD Test. (p<0.05)

This result indicated that host quality directly influence on the development of parasitoid embryo. The immature stage (larva) of *Telenomus* consumed the suitable host growth faster than those consumed lower quality hosts. The previous information showed that *I. suffrutescens* contain higher nutritional source, primarily the protein compound, rather than *V. sinensis* and *P. vulgaris*. The quality of hosts influence on the developmental time of parasitoid progeny (King, 1988).

Chapman (1982) also stated that the nutritional suitability is the most crucial factor for the succesful development of insects. The insects fed on the suitable nutrition will grow rapidly, and also have higher survival rate.

The result showed that sex ratio of *Telenomus* progeny was not influenced by host diets (Fig. 4). The progeny sex ratio was female biased (more than 70% female), regardless of host diets. This result indicated that this parasitoid species commonly produce more female than male progeny. Kalshoven (1981) also reported that *Telenomus* parasitoid produced more female progeny than males. The percentage of male progeny only 3-10%.

![Graph showing the effect of host diets on the sex ratio of Telenomus progeny.](image)

**Fig. 4.** Effect of host diets on sex ratio of *Telenomus* progeny. No significant differences among the treatments.

**References**


