

Some Biological Aspects of *Sternocera ruficornis* Saunder, 1866 in Dry Dipterocarp Forest at Sakaerat Environmental Research Station

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ABSTRACT

The buprestid, *Sternocera ruficornis* in dry dipterocarp forest at Sakaerat Environmental Research Station was investigated. The life cycle from egg to adult was approximately two years in the soil. The adults were short-lived, about one month. Eggs were oval, yellowish and deposited singly in the soil one centimeter deep at the base of *Arundinaria pusilla* Cheval. & A. Camus. Each female laid 5-12 eggs with an incubation period of 57.32 ± 2.25 days. The larva was legless and with a reduced head that was sunken into laterally expanded prothorax. The abdomen was cylindrical. There were five larval instars with the first, second, third and fourth remaining in soil and feeding on the rhizome of *A. pusilla*. The fifth instar built an earthen cell or cocoon in the soil. The last quiescent larva required at least 14 to 15 months inside the earthen cell to transform to the pupal stage. Pupation took place in earthen cell. Adults emerged from the soil, after the heavy rain during the rainy season and were active in the daytime. After copulation, the female oviposits the egg in the soil.

Key words: biology, morphology, hostplants, *Sternocera ruficornis*

INTRODUCTION

The family Buprestidae, consists of a group of insects of about eight thousand species. The larvae are borers in plant tissue, some mine in leaves, other bore into twigs, branches, woody stems or beneath the bark of trees. The eggs are usually laid in crevices in the bark. The larvae tunnel under the bark, and some species eventually bore into the wood. Pupation takes place in the gallery. Development from egg to adult can require several years (Chunram, 1974)

In Thailand there are two species of buprestid belonging to genus *Sternocera*. They are red legged *Sternocera ruficornis* and green legged *Sternocera aequisignata* which can be found in all regions of

Thailand (Ohmomo and Akiyama, 1972). Their colors are metallic dark green, copper green, bluish green, and golden green according to its beautiful and durable wings (Viravaidya and Annes, 1994). Since both species are edible and their wings are made into jewellery and other marketable objects, their numbers have declined. Also the red legged metallic beetles are quite popular among insect collectors.

They live in big groups in dry dipterocarp forest around the North-East of Thailand where *Arundinaria pusilla* grows and can be found during the rainy season. The Sakaerat Environmental Research Station situated in Wangnamkeaw District, Nakornratchasima Province was the study site because *A. pusilla* was in abundance. It is necessary

to investigate the biology of *Sternocera ruficornis* Saunder, 1866 in an attempt to successfully rear the insect in the future. The purpose of this study is to examine external morphological characteristics of adults, to study the life cycle, and to investigate the relationship of the host plant to the larval and adult stages.

MATERIALS AND METHODS

This study took place at both the Department of Entomology, Faculty of Agriculture, Kasetsart University and Sakaerat Environmental Research Station, Wangnamkaew, Nakornratchasima from January 1997 to December 1999.

Morphological study of adult *S. ruficornis*

Morphological features of the body and genitalia of 25 males and 25 females were investigated. A stereomicroscope and electronic digital caliber were used to make measurements.

Life cycle study

Ten cages of $25 \times 25 \times 25$ cm³ in size were set up. Each cage contained one male and one female. Soil from dry dipterocarp forest was put on the bottom of the cage. The number of eggs laid each day, size of egg, egg period, and percentage of hatchability were recorded. After measuring the larval size, they were brought to rear on *A. pusilla*. The larval growth was measured every week under laboratory and field conditions. The larval instars were separated by the mandibular width.

To study the pupa stage, the fifth instar larva was placed in a 20 ml vial and the vials were placed in the styrofoam boxes with soil at the bottom. They were kept in the growth chamber at 25°C and 75% RH and the development time to adult stage was recorded.

Earthen cells from the forest were also studied. Pupae in earthen cells were buried in the soil with leaf and litter of *Shorea roxburgii*, and *Xylia xylocarpa* from the Dry Dipterocarp Forest.

A cage (6x6x6 m³) was placed over the buried pupae. After, the adults emerged, their feeding, mating, egg laying, natural enemies, and longevity were recorded. The results of lab study and nature study were compared.

Host plant study

There were two groups of host plants, one for larval stage and the other for adult stage. Larvae were found digging in the vicinity of *A. pusilla* and feeding on the roots of this tree. Adult host plants were determined by visual observations with the aid of binoculars. These observations were made on forest paths and forest fire prevention boarders.

RESULTS AND DISCUSSION

Morphological study of adult *S. ruficornis*

Head

Metallic green, with punctures, convex. Frons furrowed medially. Eyes oval, brown. Antenna red-brown, serrate, eleven-segmented. First segment clubbed, the second short, the fifth to the tenth serrate, last segment truncate. Labrum distinct, with setae along margin. Mandible black, stout, margin ridged. Maxillary palpus with four segments.

Thorax

Metallic green. Pronotum convex with deep punctures, anterior margin shorter than posterior margin, posterior angles pointed. Scutellum absent. Mesosternum short, broad. Metasternum long and broad, anterior margin extends to mesosternum, arrow shape.

Wings

Elytra metallic green, slightly broader than pronotum, small punctures, humeral angle round, tip serrated, one yellow spot near humeral angle on each elytron. Hindwing membranous folded.

Legs

Red-brown, fore and middle coxa oval, hind coxa wide and expanded; trochanter small and short; femur swollen; tibia long, slender; tarsi five

segments last segment bearing a pair of claws.

Abdomen

Abdominal sternum metallic green, only five segments visible, sternite I and II fused, sternite VI with posterior margin emarginated in male, rounded in female.

Genitalia

Male. Aedeagus symmetrical, long, slender composed of penis and tegmen. Penis tubular, long and flat with acute apex, paramere length about three times of width, tapering toward both ends.

Female. Modified saccular type, a pair of hemisternites present posteriorly, each hemisternite bearing sensory process, stylus.

Body width, male 14.40 ± 0.95 mm. female 15.89 ± 1.43 mm. Body length, male 34.30 ± 2.17 mm. female 38.02 ± 3.37 mm.

The morphological characters of the male and the female were similar only that females were larger than males. Borer and Delong (1954) reported that female beetles were usually bigger than male beetles but sometimes in nature some females were found to be smaller than male due to their greater variation.

The genitalia (Figure 1) and abdominal sternite VI with posterior margin emarginated in male, rounded in female were used to separate male from female of *S. ruficornis* the same way as Chunram (1974) who used both characters to identify sexes in the genus *Chrysochroa* family Buprestidae.

The adult of *S. ruficornis* was quite similar to *Sternocera aequisignata* with some different morphological characters such as punctures on the elytra. The ones on elytra of *S. ruficornis* were deeper than those of *S. aequisignata*. Saunder (1866) reported that the colors of antennae and legs of *S. ruficornis* were red-brown whereas those of *S. aequisignata* were dark green hence the name, green legged metallic beetle. In nature, sometimes they were found together so it was difficult to separate the species.

Life cycle study (Figure 2)

Egg

Oval, yellow, smooth and no sculpturing, inner layer metallic brown. Two hard black spots on chorion. Diameter width 4.40 ± 0.17 mm, length 6.40 ± 0.29 mm.

The two hard black spots on eggshell were

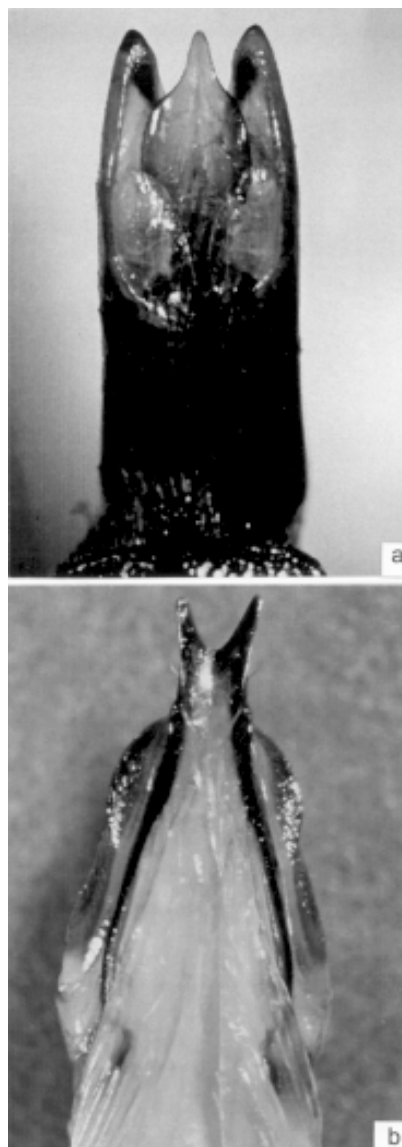


Figure 1 *Sternocera ruficornis* genitalia.

- a. male
- b. female

aeropyles. Beeson(1961) suggested that they were used by the embryo for respiration because they originated from the body wall of embryo through the surface of chorion and were important for development of embryo.

The eggs were usually laid singly in the soil at the base of *A. pusilla* about one centimeter deep to prevent being preyed upon by ants. When first laid, the egg was pale yellow and later becoming

dark yellow. Development from egg to larva was 57.32 ± 2.25 days (Table 1). Females in cages could lay 5 eggs per day. On average females laid 5-12 eggs in her oviposition period and the average percentage of hatch was 92.29.

Larva

Yellow-brown with pubescence of brown hairs. Apodous larva. Small head sunk into the prothorax. No eyes, antenna 3 segments, mouthparts

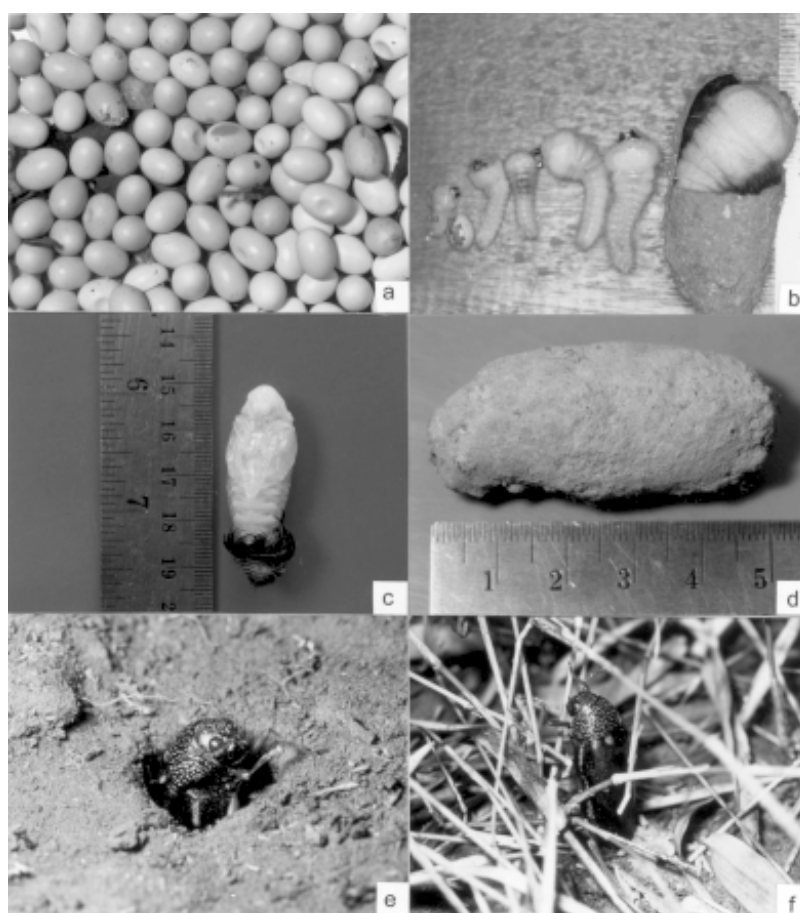


Figure 2 Life cycle of *Sternocera ruficornis*.

- a. egg
- b. larva in each stage
- c. pupa
- d. cocoon
- e. adult emerge to soil surface
- f. female lay egg

chewing type, large black mandibles. Prothorax expanded and flattened, mesothorax and metathorax small. Abdomen 9 segments, soft.

Since the larval characters of *S. ruficornis* were similar to those of beetles in subfamily Lamiini family Cerambycidae, it was hard to recognize the studied larva in nature as Beeson (1961) suggested that both larvae were encountered in same habitat and some morphological characters were the same, such as yellow color, legless, and cylindrical abdomen. Buprestid larvae are known as flat headed borers and cerambycids round head borers. There were five instars, each one was separated by mandible width (Table 2), similarly as reported by Vincent (1983) for the Malaysian buprestid larva.

Upon hatching the first instar larva made its way out of the eggshell and moved directly to feed on root of *A. pusilla*. Newly hatched larvae were found from December to January. Every stage of larval development is underground. When the larva of each instar molted, they would build an

earthen cell. At each molt, the width of mandible increased, especially at the last instar when the larva consumed a large amount of root tissue. Then it built cocoon from saliva mixed with soil. The cocoon was difficult to observe because its color blended with soil and was buried 10-15 cm from the base of *A. pusilla*. The larva remained in the cocoon for 12 – 13 months. The depth at which the cocoon was located in the soil provided protection from the damaging effects of forest fires.

Larval growth in nature was the same as in the laboratory. Development from larva to pupa was 565.90 ± 8.75 days (Table 1).

Pupa

Exarate pupa, yellow, soft. Body width 16.29 ± 1.70 mm, length 36.55 ± 1.54 mm.

At first, the pupa was yellow and soft, then it gradually became green and hardened except for antennae and legs which turned red. The pupal stage took 75.73 ± 4.48 days.

The adult emerged from the cocoon and

Table 1 Development time of *S. ruficornis* at each stage.

Stage	Period Avg \pm S.D. (days)	Range (days)	Number of sample
Egg	57.32 ± 2.25	53 – 67	77
Larva	565.90 ± 8.75	553 – 572	10
Pupa	75.73 ± 4.48	70 – 83	15
Adult - male	22.40 ± 4.06	15 – 28	10
- female	24.20 ± 2.53	21 – 29	10

Table 2 Mandibular length and body length of *S. ruficornis* larva.

Larval instar	Mandible width Avg \pm S.D. (mm.)	Body length Avg \pm S.D. (mm.)	Number of sample
First instar	1.80 ± 0.10	13.17 ± 1.75	20
Second instar	2.38 ± 0.25	24.27 ± 3.61	10
Third instar	3.68 ± 0.30	37.37 ± 2.64	10
Fourth instar	4.80 ± 0.25	44.88 ± 2.79	10
Fifth instar	5.61 ± 0.28	54.21 ± 2.64	20

came out of the ground during rainy season due to the rain water seeping into the ground and softening the cocoon. The emergences holes on the soil were round and 16.42 ± 1.00 mm in diameter. During the day, the beetles were active and this is when copulation normally occurred. The mating took place in the trees when the male approached the female. Female could mate more than once, and then would lay the eggs at the base of *A. pusilla*. Generally *S. ruficornis* laid eggs at the base of *A. pusilla* which was different from other buprestids in other genus such as genus *Chrysochroa* that laid eggs in crevices in the bark of host plants (Chunram, 1974). The larva of *Chrysochroa* hatched from egg on the bark, then burrowed into the stem and growth and development took place in the stem.

On the other hand, while in the cage females that are on a plant and allow the eggs to drop to the ground. Other behaviors were the same as found in the nature. The males life span was shorter than the females. In nature, *S. ruficornis* laid eggs at the base of *A. pusilla* but in cage it laid eggs while on the tree or cage wall. The change in behavior occurred because in the cage the adults had limited space to fly and often flew directly into the cage wall. This impact could cause stress resulting in an earlier oviposition.

Host plant study (Figure 3)

The larva was found only feeding on the rhizome of *A. pusilla* at a depth of 5-10 centimeters. The larva ate on the outside of the rhizome then burrowed into the rhizome. The rhizomes were one year or less. The larvae were not found feeding on the large roots of the tree. It is the ground covered plant in dry dipterocarp forest. There were enough food resource for all larvae.

Adults were found feeding on leaves of terminal branches. There were eleven host plants in the Dry Dipterocarp Forest (Table 3), representing 11 species from 6 families which is similar to the report by Viravaidya and Annes (1994). Hutacharearn and Tubtim (1995) suggested that *S. ruficornis* was



Figure 3 Host plant of *Sternocera ruficornis*.

- a. host plant of larva (*Arundinaria pusilla*)
- b. host plant of adult (*Albizia odoratissima*)

the forest insect pest causing damage to trees, but this study has showed that *S. ruficornis* larvae did not damage the trees like other larvae in Buprestidae therefore *A. pusilla* is not considered on economically important pest.

The natural enemies besides ants which ate their eggs on the ground included the spiders, and some species of birds.

CONCLUSION

This study provides information on the morphology, post-embryonic development and host plants of *S. ruficornis* in Dry Dipterocarp Forest. The results can be used as an aid in studying the life

Table 3 Host plants in different families of adult *S. ruficornis*.

Number	Scientific name	Family
1	<i>Shorea roxburgii</i> G. Don	Dipterocarpaceae
2	<i>Shorea obtusa</i> Wall.	Dipterocarpaceae
3	<i>Shorea siamensis</i> Miq.	Dipterocarpaceae
4	<i>Sindora siamensis</i> Teijsm. Ex. Miq.	Caesalpiniaceae
5	<i>Erythrophleum succirubrum</i> Gagnep.	Caesalpiniaceae
6	<i>Dendrolobium triangulare</i> Schindl.	Caesalpiniaceae
7	<i>Albizia odoratissima</i> Benth.	Mimosaceae
8	<i>Xylia xylocarpa</i> Taub.	Mimosaceae
9	<i>Pterocarpus macrocarpus</i> Kurz.	Papilionaceae
10	<i>Irvingia malayana</i> Olive. ex. A. Benn	Ixonanthaceae
11	<i>Phyllanthus emblica</i> Linn.	Euphorbiaceae

cycle of *S. aequesignata* which is a closely related species that does not lived in Dry Dipterocarp Forest.

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LITERATURE CITED

- Anderson, R.F. 1966. Forest and Shade Tree Entomology. John Wiley & Son Company, New York. 482 p.
- Beeson, C.F.C. 1961. The Ecology and Control of Forest Insect of India and Niegbouring Countries. Government Printing Office, New Delhi. 767 p.
- Bily, S. 1982. The Buprestid (Coleoptera) of Funnoscandia and Denmark. Scandinavian Science Press Ltd., Copenhagen. 109 p.
- Borer, D.J. and D.M. Delong. 1954. An Introduction to the Study of Insects. Holt, Rinehart and Winston, Incs, New York. 819 p.
- Chunram, S. 1974. Taxonomic Studies of Thai Metallic Wood Boring Beetle in Tribe *Chrysochroini* (Coleoptera: Buprestidae). Entomology and Zoology Division, Department of Agriculture, Bangkok. 85 p.
- Hutacharearn, C and N. Tubtim. 1995. Checklist of Forest Insects in Thailand. Office of Environmental Policy and Planning, Bangkok. 392 p.
- Ohmomo, S and K. Akiyama, 1972. Jewel Beetles. Sansho Co., Ltd., Tokyo. 59 p.
- Saunders, E. 1866. Catalogue of Buprestidae Collected by the Late M. Mouhot, in Siam with Description of a New Species. Transactions of the Entomological. Society of London 3(5) : 297-322.
- Vincent, W.Y.T. 1983. Common Malaysian Beetles, Art Printing Work Sdn. Bhd., Kuala Lumpur. 142 p.
- Viravaidya, P. and P. Annes. 1994. Some Splendid Crafts. Bangkok Printing Co., Ltd., Bangkok. 187 p.

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