Comparative Anatomy of Land snail genus *Succinea* from Eastern Thailand
(Pulmonata: Succineidae)

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**ABSTRACT**

Morphology, shell, jaw, radula, and reproductive anatomy of land snail in the genus *Succinea* from the eastern Thailand has been studied. Snails were collected from Chantaburi, Rayong and Trat Province. They were is compared with *Succinea* sp. from USA, all of investigated snails represent the *Indosuccinea* characters not only shell, jaw radula but also genitalia. This is the new data record of land pulmonate snail in this family in Thailand.

**Key Word**: Succineidae, Succinea, Morphology, Reproductive anatomy, Thailand

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INTRODUCTION

Thailand is one of the most poorly studied areas in regard to its malacological fauna, but it is an area of considerable interest due to the great number of species it contains. More than 300 species in 15 families were reported (Panha, 1996; Panha and Burch, 2005). In family Succineidae, only one genus and two species, *Succinea tenella* and *S. cochinchinensis*, were reported. (Panha, 1996). The taxonomic placement of most species of the Succineidae is still based largely on shell characters which, because of little diversity and considerable convergence, give only fragmentary or unreliable aid in systematic analyses. Currently, features of the male and female reproductive tracts, the radula and jaw and to some extent, patterns of pigmentation, are being used to characterize some genera and species (Patterson, 1971). This study, we reported on the morphological characters, shell, jaw, radula and genitalia of succineid snails which collected from several localities of Eastern Thailand. Our present study was undertaken to add to our knowledge of the morphological data of Thai succineid snails and also to determine of these characters in light of taxonomic discrimination and for showing systematics in this group.

MATERIALS AND METHODS

Field collection

Specimens of Thai succineid snails were collected from limestone mountain at several parts of Eastern Thailand (table 1) and they were compared with *Succinea* sp. from Michigan USA. Voucher specimens were deposited at Zoological Laboratory, Faculty of Science, Burapha University. Localities of the species used in this study are given in Table 1. Snails were identified using taxonomic criteria of Patterson (1971), Burch and Jung (1988), Abbott (1989) and Panha (1996).

Shell, jaw and radula morphology

Shells, jaws, radulae and specimen dissection were prepared by using criteria of Patterson (1970). The shell, jaw and genitalia were observed and photography taken by using a Olympus SZH 10 stereomicroscope. The radula observation was done on both light microscope and Scanning Electron Microscope. Observations of radulae were made using Olympus BX 50. Scanning Electron Micrographs were made using LEO 1450 VP.
RESULTS

Table 1. Species and localities of the succineid snails which used in this study.

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Succinea sp.1</td>
<td>Michigan, USA*</td>
</tr>
<tr>
<td>Succinea sp.2</td>
<td>Khao Saming, Trat Province</td>
</tr>
<tr>
<td>Succinea sp.3</td>
<td>Queen Rambhai Bharni Rajaphat University, Chantaburi Province.</td>
</tr>
<tr>
<td>Succinea sp.4</td>
<td>Khaopratoon cave, Rayong Province</td>
</tr>
<tr>
<td>Succinea sp.5</td>
<td>Khao Sukim, Chantaburi Province</td>
</tr>
</tbody>
</table>

* Collection of Chulalongkorn University Zoological Museum

**Succinea sp.1**

**Location**: USA (specimens were supported from Chulalongkorn University Zoological Museum.)

**Shell**: The shell is amber in color, very glossy inside and moderately shiny on the exterior surface, ovate-attenuate in shape with 2 ¾ whorls and aperture is oval (Figure 1A).

**Jaw**: The jaw is amber in color with the cutting piece and the basal accessory plate is nearly uniform in color. The arms of the cutting piece are elongate. The posterior margin is straight and the convex anterior margin of the cutting piece is irregular with 2 folds on each side of a distinct median prominence. The basal accessory plate is nearly square (Figure 2A).

**Radula**: The central tooth of radula is quadrate and tricuspid, the lateral teeth are also quadrate, but either bicuspid or tricuspid and the marginal teeth are variable in shape and number of cusps present. The radula formula is 21:12:1:12:21 (Figure 3A).

**Genitalia**: The genitalia show that the hermaphroditic gland is compose of many acini and is pigmented with a scattered amount of black granules. The hermaphroditic duct is covered by a thin connective tissue having scattered back pigmented areas. There are two receptacula seminis of unequal length. They are white in color. The fecundation pouch is white in color and surrounds the base of the receptacula seminis. The albumen gland is of moderate size and has a creamy, white color. The creamy white postate gland is irregularly in shape, follicular in appearance. The spermatheca has irregularly spheroid and the oviduct has irregularly in shape, they are white in color. The vagina is short, creamy beige color and is pigmented with a scattered amount of black granules. The penis is a tube approximately twice the length of the vagina. It has a white color. The penis constricts abruptly at its posterior end at the junction with the shot epiphallus. There is a well developed penial sheath which is black pigment granules appressed to the penis near the base (Figure 4A and 5A).
**Succinea sp. 2**

**Location**: Khao Saming, Trat Province.

**Shell**: The shell is amber in color, very glossy inside and moderately shiny on the exterior surface, ovate-attenuate in shape with 2 ½ whorls, collemella fold exists. A aperture is oval (Figure 1B).

**Jaw**: The jaw is amber in color with the cutting piece and the basal accessory plate is nearly uniform in color. It is wider than high when measured at the greatest dimension. The arms of the cutting piece are short. Both posterior and anterior margin are straight. The basal accessory plate is nearly square (Figure 2B).

**Radula**: The central tooth of radula is quadrate, the lateral teeth are also quadrate, but either bicuspid or tricuspid and the marginal teeth are variable in shape and number of cusps present. The radula formula is ∞:5:1:5:∞ (∞ > 60) (Figure 3B).

**Genitalia**: The genitalia show the hermaphrodite is pigmented with a scattered amount of black granules. The hermaphrodite duct and two equal receptacula seminis are covered by a thin connective tissue having scattered black pigmented areas. There is a distinct fecundation pouch which resembles the shape of the receptacula seminis. The albumen gland is of large size and has a creamy, yellow color. The creamy yellow prostate gland is two irregularly spheroid. The white translucency spermatheca has a global shape. The oviduct is gelatinous like and has a many folds. The vagina is moderately long, white in color. The penis sheath well development, large and long size (Figure 4B and 5B).

**Succinea sp. 3**

**Location**: Queen Rambhai Bharni Rajaphat University, Chantaburi Province. They were found on the leaf of orchid and tree near the building.

**Shell**: The shell is amber in color, very glossy inside and moderately shiny on the exterior surface. The shell is ovate-attenuate in shape with 2 ½ . The aperture is oval (Figure 1C).

**Jaw**: The jaw is amber in color with the cutting piece and the basal accessory plate is nearly uniform in color. The posterior margin of the basal accessory plate and the anterior margin of the cutting piece are straight. There is no median prominence and the posterior margin of the cutting piece slant slight (Figure 2C).

**Radula**: The central tooth of radula is quadrate, the lateral teeth are also quadrate, but either bicuspid or tricuspid and the marginal teeth are variable in shape and number of cusps present. The radula formula is 55:6-7:1:6-7:55, (Figure 3C).
Genitalia: The genitalia show that the hermaphrodite gland is composed of many acini and is pigmented with a scattered amount of black granules. The hermaphrodite duct and two equal receptacula seminis are covered by a thin connective tissue having scattered black pigmented areas. There is a distinct fecundation pouch which resembles the shape of the receptacula seminis. The albumen gland is of large size and has a creamy, yellow color. The creamy yellow prostate gland is two irregularly spheroid. The white translucency spermatheca has a global shape. The oviduct is gelatinous like and has a many folds. The vagina is moderately long, white in color. The penis is a small tube, white in color and covered by a thin connective tissue having scattered black pigmented areas (Figure 4C and 5C).

Succinea sp. 4:
Location: specimens were collected from Khao Pratoon, Rayong Province. They were found on leaf and also found together with Durgella sp.
Shell: The shell is amber in color, very glossy inside and moderately shiny on the exterior surface. The shell is ovate-attenuate in shape with 2½. The aperture is oval (Figure 1D).
Jaw: The jaw is amber in color with the cutting piece and the basal accessory plate is nearly uniform in color. It is wider than high when measured at the greatest dimension. The anterior margin of the cutting piece is deeply. The sides of the basal accessory plate slant slightly inward. The posterior margin of basal accessory plate is irregular (Figure 2D).
Radula: The radula of this species show that the central tooth is quadrate and tricuspid, the lateral teeth are also quadrate, but either bicuspid or tricuspid and the marginal teeth are variable in shape and number of cusps present. The radula formula is 82:7:1:7:82. (Figure 3D).
Genitalia: The genitalia show that the hermaphroditic gland is composed of many acini. There are two receptacula seminis of equal length, white color and a well developed fecundation pouch. The hermaphroditic duct, Receptacula seminis and fecundation pouch are covered by a thin connective tissue having scattered black pigmented areas. The albumen gland is a white color and has a irregularly shape. The white prostate gland and the creamy white spermatheca are global in shape. The oviduct is gelatinous like, white in color and irregular with many folds. The vagina is moderately long, white in color. The penis is a tube, longer than vagina. The penis sheath well developed, is also purple-light and long size. (Figure 4D and 5D).
Figures 1. Comparative morphology of succineid snails in this study.

1: shell (1 mm.), 2: jaw, 3: radula (20 µm), 4: receptaculum seminis and 5: penis sheath

A: *Succinea* sp.1, B: *Succinea* sp.2, C: *Succinea* sp.3, D: *Succinea* sp.4 and E: *Succinea* sp. 5.

*Succinea* sp.5.

**Location**: Khaosukim, Chantaburi Province

**Shell**: The shell is amber in color, very glossy inside and moderately shiny on the exterior surface. The shell is ovate-attenuate in shape with 2½. The aperture is oval (Figure 1E).

**Jaw**: The jaw is amber in color with the cutting piece and the basal accessory plate is nearly uniform in color. The arms of the cutting piece are short. Posterior margin are straight and...
convex anterior margin of the cutting piece is irregular with 2 folds on each side of a distinct median prominence. The basal accessory plate is nearly square (Figure 2E).

**Radula**: Radula of this species show that central tooth is quadrate and tricuspid, the lateral teeth are also quadrate, but either bicuspid or tricuspid and the marginal teeth are variable in shape and number of cusps present. The radula formula is 82:7:1:7:82 (Figure 3E).

**Genitalia**: The genitalia show the hermaphrodite is pigmented with a scattered amount of black granules. The hermaphrodite duct and two equal receptacula seminis are covered by a thin connective tissue having scattered black pigmented areas. There is a distinct fecundation pouch which resembles the shape of the receptacula seminis. The albumen gland is of large size and has a creamy, yellow color. The creamy yellow prostate gland is two irregularly spheroid. The white translucency spermatheca has a globular shape. The oviduct is gelatinous like and has many folds. The vagina is moderately long, white in color. The penis sheath is white and more light in color than snail from Trat Province and well developed, large and long size. (Figure 4E and 5E).

**DISCUSSION**

The shell is the most prominent and preservable morphological structure of most gastropod. The taxonomy of many gastropod is based mainly on characters of the shell. However, the shells of *Succinea sp.* generally lack the diversity of characters need for identification and classification. In comparing *Succinea* sp. from USA to Thai succineid snails, one finds that the shell is differences in spire. The spire of Thai succineid snails were considered shorter than *Succinea* sp. from USA. The jaw of all snails are composed of a cutting piece attached to a basal accessory plate where differences do occur, they usually seem to be species specific. As show in the result, the convex anterior margin of the cutting piece is irregular with two folds on each side of a distinct median prominence was found in *Succinea* from USA while Thai succineid species show the anterior margin of the cutting piece which are straight and no median prominence. The posterior margin of the cutting piece slant slight. All of these characters represent the jaw morphology of genus *Indosuccinea* as reported by Patterson (1971). Radula structure of all species show the difference in morphology. The radula teeth have a relatively simple structure. The central tooth is quadrate, a cusp and tricuspid. The lateral teeth are also quadrate, but either bicuspid or tricuspid and the marginal teeth are variable in shape and number of cusps present. However, Patterson (1971) suggested that the radula does not possess characters useful in delineating genera but may, in some cases, possess taxonomically useful species specific features. The characteristic of Thai succineid snails summarized that it has very fragile shell nature of the shell, its characteristic shape, the strongly chitinized jaw with
beake-like extremities to the arms and the large number of marginal teeth in the radula. These characters look very closely to the characteristic of the genus *Indosuccinea* which reported by Rao (1924). The last character which observed is genitalia; there are two receptacula seminis of equal length in Thai succineid snails while *Succinea* sp. from USA, two receptacula seminis are unequal. This is the highly strong character which separated snails genus *Indosuccinea* from *Succinea* and we found that in all thai succeinid snail samples.

**CONCLUSION**

From our study, Thai succineid snails show neither the morphological characters of genus *Indosuccinea* nor *Succinea* as previous reported. We suggested that it could be placed them to genus *Indosuccinea*. This is the new data record of Thai succineid snail however more data such as reproductive anatomy, cytology, molecular biology, etc., will combine in the future report for the taxonomic discrimination and for showing systematics in this group.

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**REFERENCES**


