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ORIGINAL ARTICLE

ADDITIONAL INFORMATION OF *AMPHIDROMUS INVERSUS ANNAMITICUS* (CROSSE & P. FISCHER, 1863) (GASTROPODA, STYLOMMATOPHORA, CAMAENINAE) FROM VIETNAM

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ABSTRACT

As a part of the survey discovering the land snail fauna of Can Tho City, Vietnam, this study recorded snails for the first time in the city and an additional data on *Amphidromus inversus annamiticus* (Crosse & P. Fischer, 1863) for the plains of the Cuu Long River Delta. *A. inversus annamiticus* found in the study area has two types of shell spiraling, both dextral and sinistral, with or without a blackish brown spiral streak from the apex. All of the shells without that streak are sinistral and bigger in size compared to the ones with the color streak. Snail individuals were hibernating on the branches and trunks of landscape trees that include, *Dipterocarpus alatus*, *Samanea saman*, *Khaya senegalensis*, and *Erythrina fusca*.

Keywords: *Amphidromus*, Camaeninae, Land snails, Plains, Vietnam.

INTRODUCTION

Amphidromus inversus annamiticus (Crosse & Fischerm 1863) is a member of a large snail genus, *Amphidromus* Albers, 1850, characterized by its colorful shells and arboreal habit, especially by the presence of dimorphic shells spiraling called dextral (clockwise) and sinistral (counterclockwise). The subspecies was reported in some countries of Southeast Asia, such as Vietnam, Cambodia, Thailand, and Laos presented that having two shell coiling styles (Pilsbry, 1900; Laidlaw and Solem 1961; Solem, 1965; Sutcharit and Panha, 2006; Schileyko, 2011; Inkhavilay *et al*., 2017).

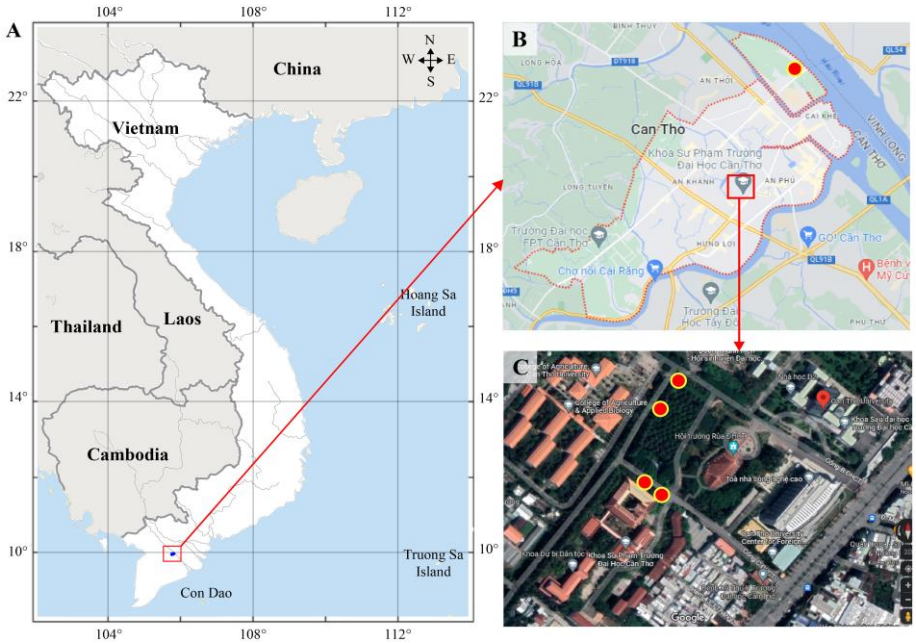
The Cuu Long River Delta, Mekong Delta, or Southeastern Vietnam is a large part of the south of Vietnam, including both the mainland and islands of 13 provinces and cities. The mainland part has an area of 39,747 km2 located between 8°34'N-11°10'N and 104°25'E-106°48'E. The delta is one of the most biodiversity places in Vietnam with 12 natural conservation areas (National Parks, Natural Reserves, and Biosphere Reserves) were known currently. The terrain of the Cuu Long River Delta is almost plain, with some mountains and islands in the west, the bordering Cambodia and Thailand gulf (Le *et al*., 2010). Besides the data of land snails reported in mountainous and islands with 45 species recorded, there were

seven species found in plain of Tram Chim National park (Dong Thap Province) and Cu Lao Dung (Soc Trang Province) (Pfeiffer, 1861; Crosse and Fischer, 1863; Bavay and Dautzenberg, 1909; van Benthem Jutting, 1962; Vermeulen *et al*., 2007; Schileyko, 2011; Do *et al*., 2012; Nguyen and Nguyen, 2016; Nguyen *et al*., 2020; Tran *et al*., 2021). Also, there was no report of *A. inversus annamiticus* in the plain of the delta.

This study aims to provide the first data on land snails in Can Tho City and additional information about *A. inversus annamiticus* in the Cuu Long River delta.

MATERIALS AND METHODS

Specimens collection and photographs: The survey was performed in March 2023 around Can Tho City, Vietnam. There were five sampling sites (Map 1) having the presence of *Amphidromus inversus annamiticus* (Tabl. 1). Snails were collected by hand sorting for all alive individuals and dried shells following the method of Vermeulen and Maassen (2003). The specimens collected were packed in a plastic box that had notes about the time, location, GPS coordinates, and habitat of the sampling site. After that, snails were put on leaves to unfreeze them, and then pictures were captured to show their morphologies alive. Snail bodies were removed from their shells and then preserved in 70% alcohol solution; the empty shell was cleaned by using fire ants.



Map (1): Shows map of collecting specimens of *Amphidromus inversus annamiticus*; (A) Vietnam map, (B) Map of Ninh Kieu District (Can Tho City), (C) sampling locations in Campus II, Can Tho University.

The morphology of snail pictures was taken by a Fujifilm XA3 digital camera, and grouped using Adobe Photoshop CS6 software. All morphological measurements were conducted in millimeters. All shells and bodies of snails were deposited, along with the collection of land snails in the Laboratory of Zoology, School of Education, Can Tho University.

Specimens' identification: Snails collected were identified the morphologies of their shells as follow the descriptions and keys of Sutcharit and Panha (2006), Nguyen and Nguyen (2016); plants identifications and information were used followed the description on National Parks Flora and Fauna Web (2023). The source of species names and synonyms were from Crosse and Fischer (1863), Mabille and Mesle (1866), Morlet (1889), Pilsbry (1900), Laidlaw and Solem (1961), Solem (1965), Sutcharit and Panha (2006), Schileyko (2011), Nguyen and Nguyen (2016). Gude (1902), Abbott (1989), and Zilch (1953).

Abbreviation

H = Shell heigth, D = Shell wide, L_0 = Aperture heigth, $l_{0\,=}$ Aperture wide

RESULTS AND DISCUSSION

Totally, 18 alive snails (13 dextral and five sinistral spiralings) have been found, hibernating on the trunks and branches of *Dipterocarpus alatus* Roxb. (eight matures), *Samanea saman* (Jacq.) Merr. (two matures), *Khaya senegalensis* (Desr.) A. Juss. (two matures), and *Erythrina fusca* Lour. (six immatures). However, only seven individuals of mature snails were collected for classification and morphological analyses. Among 18 individuals recorded, 16 shells had a blackish brown spiral streak from the apex, faded to the third whorl, and two shells had no blackish brown spiral streak (only sinistral spiraling).

Family, **Camaenidae** Albers, 1850

Genus, ***Amphidromus*** Albers, 1850

Amphidromus inversus annamiticus (Crosse & Fischer, 1863)

Original name: *Bulimus annamiticus* Crosse and Fischer, 1863: 357-359 (Saigon, Vietnam; syntype MNHM). Mabille and Mesle, 1866: 128.

Synonyms: *Amphidromus annamiticus* – Morlet, 1889: 126.

Amphidromus inversus annamiticus – Pilsbry, 1900: 169–170. Laidlaw and Solem, 1961: 561, 600. Solem, 1965: 624. Sutcharit and Panha 2006: 9. Schileyko, 2011: 50. Nguyen and Nguyen, 2016: 106.

Amphidromus inversus annamiticus var. *roseotincta* – Pilsbry, 1900: 170. Laidlaw and Solem, 1961: 561, 655–656. Solem, 1965: 624.

Amphidromus inversus var. *annamiticus* – Gude, 1902: 50, 51. Abbott, 1989: 160.

Amphidromus inversus roseotincta – Zilch, 1953: 135.

Material examined: 05 alive matures (03 dextral, 02 sinistral) (LS.012.06), *Dipterocarpus alatus* trunk (10°01'48.8"N 105°46'07.3"E), Campus 2, Can Tho University, Can Tho City, 1.iii.2023; 02 alive matures (sinistral) (LS.012.07), *Khaya senegalensis* trunk (10°03'43.8"N, 105°46'55.6"E), Khuong Islet, Ninh Kieu District, Can Tho City, 2.iii.2023, all coll. Lam Hai Dang.

Additional information of *Amphidromus*

Table (1): Collecting sites of *Amphidromus inversus annamiticus* in Can Tho City, Viet Nam

Number of snail found		04 alives	04 alives	04 alives	04 alives	02 alives
Collector		Lam Hai Dang	Lam Hai Dang	Lam Hai Dang	Lam Hai Dang	Lam Hai Dang
Time		01 Mar. 2023	01 Mar. 2023	01 Mar. 2023	01 Mar. 2023	02 Mar. 2023
Location		Campus 2, Can Tho University	Campus 2, Can Tho University	Campus 2, Can Tho University	Campus 2, Can Tho University	Khuong Islet
GPS coordinates		10°01'49.6"N 105°46'07.6"E	10°01'48.8"N 105°46'07.3"E	10°01'44.8"N 105°46'06.1"E	10°01'44.2"N 105°46'07.0"E	10°03'43.8"N, 105°46'55.6"E
Vegetation	Description and ethnobotany	Flowers produced as dense powderpuff cluster with numerous filamentous stamens, pink above and white below. Seed fleshy with thickened edges and constricted in between seeds; contain numerous dark brown seeds embedded in sticky, brownish-black pulp. Leaves alternate, bipinnately-compound, with small asymmetrical leaflets.	Flowers large, bisexual; calyx 5 parts, 2 are long, while 3 short; petals large, strongly contorted, cream-white with a pink, red or purple stripe down the center. Nut surrounded by the calyx, comparatively large; calyx tube glabrous, subglobose, 5 wings of 8 mm broad. Leaves are narrowly ovate to elliptical-oblong, base rounded, apex acute, sparsely pubescent above, beneath densely pubescent.	Flowers bright red; flowers stalked, held along one main axis (raceme). Fruits are flattened woody pods (15-20 cm long, 2 cm wide); the pod has a velvet-like texture, contains 3 - 15 ellipsoid seeds. Leaf is trifoliate, consisting of 3 ovate leaflets; the terminal leaflet is slightly larger than the lateral leaflets.		Flowers less than 1cm wide, borne in clusters, and pale white in color; each has 5 small petals. Fruits have woody capsules which split open with 3 or 4 valves; Each fruit contains numerous seeds with brown wings at two ends, horizontally arranged. Leaf arrangement is alternate; the leaves are odd or pinnate compounds. The leaflets are oblong, dark green on the upper but more light on the underside
	Vietnamese name	Còng	Dầu con rái	Muồng hoa đỏ		Xà cừ
	Common name	Rain tree	Resin tree	Purple coraltree		African mahogany
	Scientific name	*Samanea saman* (Jacq.) Merr.	*Dipterocarpus alatus* Roxb.	*Erythrina fusca* Lour.	*Erythrina fusca* Lour.	*Khaya senegalensis* (Desr.) A. Juss.
No.		1	2	3	4	5

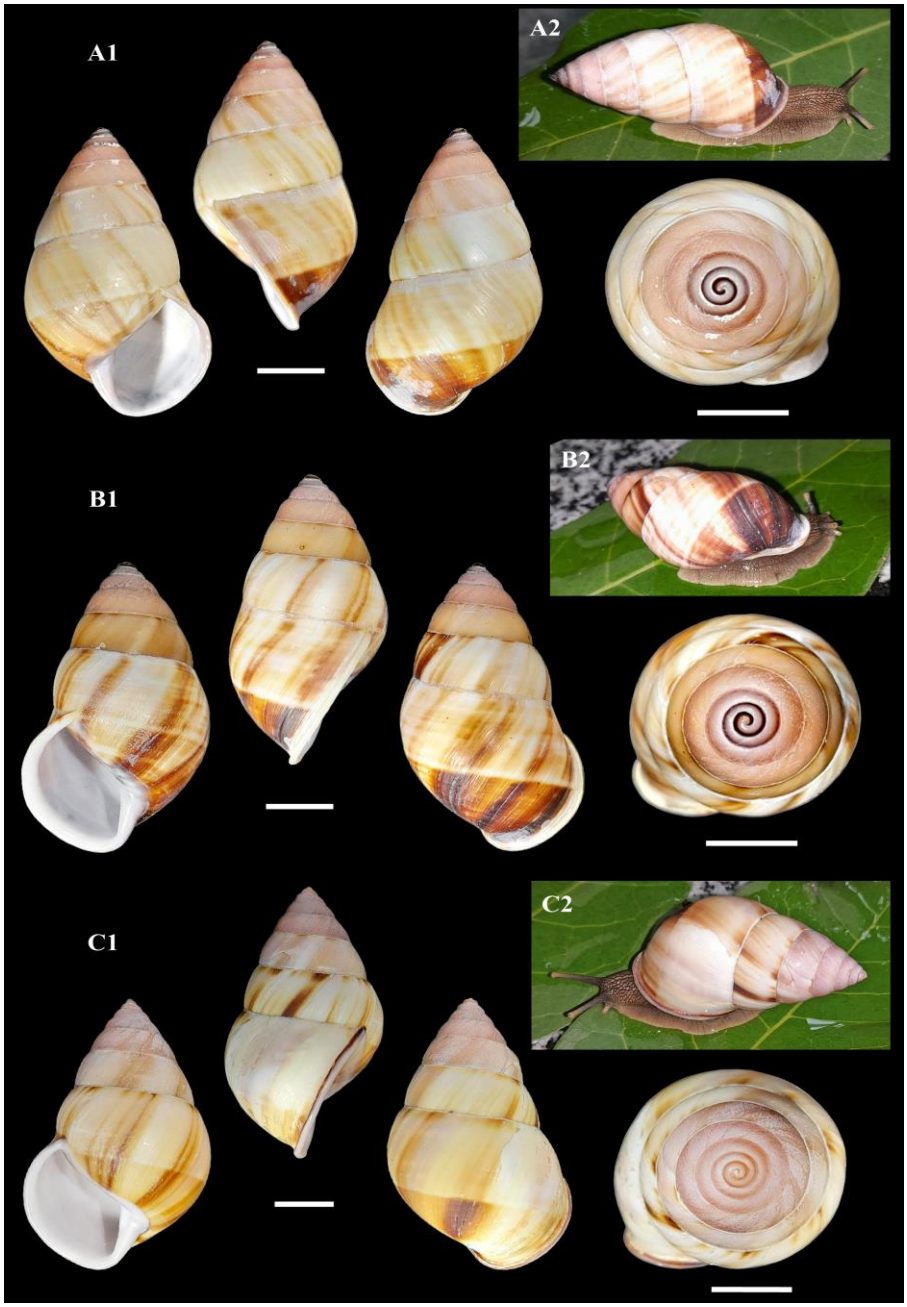


Plate (1): Shells (1) and alive individuals (2) of *A. inversus annamiticus*; (A) Dextral snail with brown spiral streak, (B) Sinistral snail with brown spiral streak, (C) Sinistral snail without brown spiral streak. Scale bar = 10mm.

Additional information of *Amphidromus*

Description: Large-sized shell snail (H = 44.3 – 51.6, D = 24.5 – 31.5, L_0 = 19.2 – 24.1, l_0 = 17 – 21); dimorphically coiled; near rhombus shaped; last whorl has lower half in blackish brown (clearly separated); color gradually lightens to the top whorls, intermingled of pink and brown streaks that same direction with the growth lines; shell thickened and smooth; spire high and narrow; seven whorls with clear suture; the first four whorls slightly pink, with or without a blackish brown spiral streak from the apex; aperture broad, ovate, without operculum; Parietal callus white or transparent; peristome white, smooth, slightly thickened, folded; umbilicus small, obscured by peristome folded.

Distribution: Vietnam (Kien Giang, An Giang, Ho Chi Minh city, Dong Nai, Phu Yen); Cambodia; Thailand; Laos (Laidlaw and Solem, 1961; Sutcharit *et al*., 2006; Schileyko, 2011; Inkhavilay *et al*., 2017; Nguyen and Nguyen, 2016).

Remark: Individuals without blackish brown spiral streak having a large size (H = 48.2 – 51.6 mm, D = 28.7 – 31.5, L_0 = 20.3 – 24.1, l_0 = 19.2 – 21.0) than the whole with that streak (H = 44.3 – 47.4, D = 24.5 – 27.0, L_0 = 19.2 – 23.0, l_0 = 17.0 – 17.8).

Prior to this study, several records found *A. inversus annamiticus* in the Cuu Long River Delta only in mountains and islands of Kien Giang Province (Kien Luong Distr., Ha Tien Distr., and Kien Hai Distr.: Hon Tre Isl., Lai Son Isl., An Son Isl.), and mountains in An Giang Province, no reports were found in the plains. In the survey of three islands of Kien Giang Province, Nguyen and Nguyen found that the subspecies usually hang on the branches and leaves of mango trees (Laidlaw and Solem, 1961; Sutcharit *et al*., 2006; Schileyko, 2011; Inkhavilay *et al*., 2017; Nguyen and Nguyen, 2016). On the contrary, there were no individuals of the snail found in that type of tree but in landscaping plants (*Dipterocarpus alatus*, *Samanea saman*, *Khaya senegalensis*, and *Erythrina fusca*) in this study. In addition, tourism has developed very well in recent years, and tourists tend to go to islands and mountains around the delta. This situation has posed the question that the taxon has already been here or just been picked up by artificial effects. However, this study just provides new records of *A. inversus annamiticus* in the plains of the Cuu Long River Delta, the evidence to prove the state about the appearance of the taxon in this region is rudimentary, so more data needs to be collected to have a better discussion.

CONCLUSIONS

A. inversus annamiticus was found in the plains of the Cuu Long River Delta in five sampling sites. Among 18 individuals found, including dextral and sinistral spiral shells, and with or without blackish brown spiral streak. This study provided the first data on the taxon in the plains of the delta. Snails only hanging on the landscaping trees lead us to a question about whether the taxa appear in the study area. However, that state is just a first thought and needs more data for further analysis.

CONFLECT OF INTEREST STATEMENT

The author declares no conflict of interest related to the work in a manuscript.

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(2023) 17(4): 531-539.

معلومات إضافية عن القوقع
Amphidromus inversus annamiticus (Crosse & P. Fischer, 1863)
(Gastropoda, Stylommatophora, Camaeninae)
من فيتنام

دانغ هاي لام

قسم علوم الحياة، كلية التربية، جامعة كان ثو، مدينة كان ثو، فيتنام.

تأريخ الاستلام: 2023/3/30، تأريخ القبول: 2023/6/5، تأريخ النشر: 2023/12/20

الخلاصة

سجلت هذه الدراسة النويع لأول مرة في مدينة كان ثو، فيتنام *Amphidromus inversus annamiticus* (Crosse & P. Fischer, 1863) ، كجزء من المسح لاستكشاف فونا القواقع الأرضية مع بيانات إضافية عنه لسهول المنطقة، دلتا نهر كو لونغ، و عثر على شكلين من الصدفة الحلزونية المعكوسة في منطقة الدراسة، كلاهما من النوع dextral و sinistral، ذو خط حلزوني بني مسود من القمة او بدونه.

جميع الأصداف التي لا تحتوي على الخط تكون متعرجة وأكبر حجمًا مقارنة بتلك التي تحتوي عليه. أفراد القواقع التي لوحظت خلال الدراسة كانت في حالة سبات شتوي على أغصان وجذوع الأشجار الطبيعية التي ضمت: *Dipterocarpus alatus* و *Samanea saman* و *Khaya senegalensis* و *Erythrina fusca*.