

**Research Article**

**STUDIES ON INTERNAL REPRODUCTIVE ORGANS OF THREE SPECIES OF GENUS *HYPOCALA* GUENÉE (NOCTUIDAE: LEPIDOPTERA)**

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**ABSTRACT**

The reproductive organs of three species viz., *rostrata* (Fabricius) and *sabsatura* Guenée and *deflorata* (Fabricius) have been studied and illustrated here for the first time. A key to these three species on the basis of internal genitalic structures has been devised. The reporting of two testes in species *Hypocala sabsatura* Guenée is an exception and is a new report.

**Keywords:** *Noctuidae, Hypocala Guenee, Reproductive Organs, Lepidoptera*

**INTRODUCTION**

Genus *Hypocala* was proposed by Guenée (1852) on the type species *deflorata* Fabricius. Hampson (1894) studied 6 species i.e., *deflorata* (Fabricius), *sabstura* Guenée, *rostrata* (Fabricius), *moorei* Butler, *violacea* Butler, *biarcuata* Walker, *lativitta* (Moore) under genus *Hypocala* Guenée from India. The present collection-cum-survey tours led to the collection of three species *rostrata* (Fabricius) and *sabsatura* Guenée and *deflorata* (Fabricius) which were critically examined for the study of internal male and female reproductive organs. The characters like free accessory glands with transparent tip; entrance of cuticular tube is apical and origin of ductus seminalis from ductus bursae in all the three species conforms to the characterization of the same genus. However, there are some other specific attributes like entrance of vasa deferentia into ductus ejaculatorius duplex; shape of the testis; presence/absence of eggs in lateral and common oviduct which can be used to distinguish these species from each other.

**MATERIALS AND METHODS**

The adult Noctuid moth species were collected from the florescent lights fitted at different localities in various states of India. The collected moths were killed and preserved in air tight wooden boxes. The identification of captured specimens was done with the help of relevant literature (Hampson, 1895). For the preparation of external male and female genitalia slides, abdomen of preserved specimens were detached and potashed in 10% solution (Robinson 1976), washed in 1% glacial acetic acid and dissected in 30% alcohol for taking out external male and female genitalia.

**RESULTS AND DISCUSSION**

**Observation**

**Genus *Hypocala* Guenée**

*Hypocala* Guenée, 1852, *Noct.*, **3**: 73.

**Type Species:** *Hypocala deflorata* Fabricius.

**Distribution:** Throughout the tropical and subtropical range.

**Key to the Species of Genus *Hypocala* Guenée**

1. Male reproductive organs with testis ellipsoidal; primary  
simplex divided into five  
sections.....
- Male reproductive organs with testis rounded; primary  
simplex divided into two  
sections.....

***H. sabsatura* Guenée**

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2. Male reproductive organs with seminal vesicle-I fused; vasa deferentia entering into ductus ejaculatorius duplex beyond middle towards primary simplex; female reproductive organs with signum rounded, wheel like; pedicel present.....

***H. rostrata* (Fabricius)**

- Male reproductive organs with seminal vesicle-I free; vasa deferentia entering into ductus ejaculatorius duplex beyond middle towards accessory gland; female reproductive organs with signum conical; pedicel absent.....

***H. deflorata* (Fabricius)**

***Hypocala sabsatura* Guenée**

Guenée, 1852, *Noct.*, **3**: 75.

(Plate – 1)

**Male reproductive system:** Testis yellowish, ellipsoidal, two testes present separately i.e., a primitive condition; seminal vesicle-I creamish, originating from testis separately, parallel; seminal vesicle-II creamish, balloon shaped; vasa deferentia opaque, tubular, entering into ductus ejaculatorius duplex beyond middle towards primary simplex; ductus ejaculatorius duplex creamish, C-shaped; primary simplex divided into five sections, section-I opaque, V shaped, section-II transparent, curved, section-III opaque, straight, section-IV translucent, stiff, highly coiled, section-V milky-opaque, curved; constrictor muscular area with cuticular simplex creamish, curved; cuticular tube opaque, entering into aedeagus apically, not modified into bulbous ejaculatorius; accessory gland opaque, free, convoluted throughout, transparent at tip.

**Table 1: Morphometry of internal male reproductive organs of *Hypocala sabsatura* Guenée**

S. No.	Organ	Length (mm)	Intraspecific range in length (mm)	Width (mm)	Intraspecific range in width (mm)
1.	Testis	0.57	0.55-0.59	0.85	0.83-0.87
2.	Seminal Vesicle - I	0.28	0.26-0.30	0.19	0.17-0.21
3.	Seminal Vesicle - II	0.66	0.64-0.68	0.47	0.45-0.49
4.	Vasa deferentia	3.23	3.20-3.25	0.08	0.07-0.09
5.	Ductus ejaculatorius duplex	3.14	3.12-3.16	0.28	0.26-0.30
6.	Primary simplex	37.69	37.59-37.79	-	-
	Section – I	2.66	2.64-2.68	0.25	0.24-0.26
	Section – II	2.47	2.45-2.49	0.18	0.17-0.19
	Section – III	2.38	2.36-2.40	0.19	0.17-0.20
	Section – IV	10.28	10.26-10.30	0.36	0.35-0.37
	Section – V	19.90	19.88-19.92	0.39	0.38-0.40
7.	Constrictor muscular area	2.47	2.45-2.50	0.47	0.45-0.50
8.	Cuticular tube	0.15	0.13-0.17	0.11	0.09-0.12
9.	Accessory gland	17.23	17.20-17.26	0.18	0.17-0.19

**Female reproductive system:** Not studied.

**Wing expanse:** 44 mm

**Old distribution:** N.W. Himalayas; Canara; Nilgiris.

**Material Examined:**

Shimla: Koti, 27.vi.07, 4♂♂; Kharapathar, 30.vi.07, 4♂♂; Cheog, 29.vi.07, 2♂♂.

Kangra: Balakrupi, 8.vii.06, 2♂♂.

Solan: Gharkhal, 4.v.06, 3♂♂.

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**Remarks:** In the male reproductive system two testes present separately which is an exception reported for the first time in this species.

***Hypocala rostrata* (Fabricius)**

Fabricius, 1794, *Syst. Ent.*, **3**: 127.

**(Plate – 2)**

**Male reproductive system:** Testis yellowish, rounded; seminal vesicle-I creamish, originating from testis in fused state, parallel; seminal vesicle-II creamish, balloon shaped; vasa deferentia opaque, tubular, entering into ductus ejaculatorius duplex beyond middle towards primary simplex; ductus ejaculatorius duplex creamish, C shaped; primary simplex divided into two sections, section-I translucent, curved, section-II milky-opaque, curved; constrictor muscular area with cuticular simplex opaque, curved; cuticular tube opaque, entering into aedeagus apically, not modified into bulbous ejaculatorius; accessory gland opaque, free, curved throughout, transparent at tip.

**Table 2: Morphometry of internal male reproductive organs of *Hypocala rostrata* (Fabricius)**

S. No.	Organ	Length (mm)	Intraspecific range in length (mm)	Width (mm)	Intraspecific range in width (mm)
1.	Testis	0.45	0.43-0.47	0.50	0.48-0.52
2.	Seminal Vesicle - I	0.50	0.48-0.52	0.20	0.18-0.22
3.	Seminal Vesicle - II	0.75	0.73-0.77	0.50	0.48-0.52
4.	Vasa deferentia	2.75	2.73-2.78	0.07	0.06-0.08
5.	Ductus ejaculatorius duplex	3.08	3.06-3.10	0.25	0.23-0.27
6.	Primary simplex	46.07	46.03-46.11	-	-
	Section – I	31.41	31.39-31.43	0.12	0.11-0.14
	Section – II	14.66	14.64-14.68	0.21	0.19-0.22
7.	Constrictor muscular area	1.75	1.73-1.77	0.33	0.31-0.35
8.	Cuticular tube	0.16	0.14-0.18	0.13	0.11-0.15
9.	Accessory gland	8.75	8.72-8.80	0.14	0.12-0.16

**Female reproductive system:** Common terminal filament creamish, curved; ovaries creamish, having four egg tubes on each side; eggs creamish, rounded; pedicel opaque; lateral oviduct translucent, without eggs; common oviduct translucent, without eggs; infundibulum rounded; spermathecal duct opaque, straight; spermatheca bilobed i.e. utriculus translucent, tubular; lagena translucent, rounded; spermathecal gland opaque, curved, not bifurcated at tip; corpus bursae creamish, irregular rounded, sclerotised; signum brownish, rounded, wheel-like; ductus bursae creamish brown, not sclerotised; ostium bursae brownish, sclerotised; ductus seminalis translucent, crenulated, arising from ductus bursae; bulla seminalis opaque, bean shaped; accessory gland reservoir duct transparent, straight; common accessory gland reservoir transparent, rounded, ball like; lateral accessory gland reservoir transparent, spindle shaped; accessory gland translucent, coiled, arising from tip of reservoir; vestibulum creamish; vagina creamish.

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**Table 3: Morphometry of internal female reproductive organs of *Hypocala rostrata* (Fabricius)**

S. No.	Organ	Length (mm)	Intraspecific range in length (mm)	Width (mm)	Intraspecific range in width (mm)
1.	Common terminal filament	6.20	6.18-6.20	0.08	0.07-0.09
2.	Egg tube	32.93	32.91-32.95	0.12	0.11-0.14
3.	Pedicel	0.40	0.38-0.42	0.13	0.11-0.15
4.	Lateral oviduct	1.66	1.64-1.68	0.14	0.12-0.15
5.	Common oviduct	0.86	0.84-0.88	0.20	0.18-0.22
6.	Infundibulum	0.10	0.09-0.12	0.10	0.09-0.11
7.	Spermathecal duct	0.86	0.84-0.88	0.11	0.10-0.13
8.	Utriculus	1.46	1.44-1.48	0.26	0.25-0.28
9.	Lagena	0.46	0.44-0.48	0.33	0.31-0.35
10.	Spermathecal gland	14.40	14.38-14.44	0.13	0.12-0.15
11.	Corpus bursae (diameter)	5.53	5.51-5.56	-	-
12.	Ostium bursae (diameter)	0.60	0.58-0.62	-	-
13.	Ductus bursae	3.80	3.78-3.82	0.20	0.18-0.22
14.	Ductus seminalis	3.73	3.70-3.75	0.08	0.09-0.10
15.	Bulla seminalis	0.93	0.91-0.95	0.33	0.31-0.35
16.	Accessory gland reservoir duct	0.93	0.90-0.95	0.13	0.11-0.15
17.	Common Accessory gland reservoir	0.26	0.25-0.28	0.31	0.29-0.32
18.	Lateral Accessory gland reservoir	2.13	2.11-2.15	0.40	0.38-0.42
19.	Accessory gland	10.73	10.70-10.78	0.13	0.11-0.15
20.	Vestibulum	0.15	0.14-0.17	0.26	0.24-0.27
21.	Vagina	0.13	0.11-0.15	0.40	0.38-0.42

**Wing expanse:** 46 mm.

**Old distribution:** E. & S. Africa; N. W. Himalyas; Canara; Nilgiris.

**Material Examined:**

Shimla: Koti, 23.vi.0, 1♂, 2♀♀, 7.vii.08, 1♂; Kharapathar, 22.vi.06, 2♂♂, 2♀♀.

***Hypocala deflorata* (Fabricius)**

Fabricius, 1794, *Ent. Syst.*, **3**: 472.

**(Plate – 3)**

**Male reproductive system :** Testis yellowish, rounded; seminal vesicle-I opaque, originating from testis separately, intercrossed; seminal vesicle-II creamish, globular; vasa deferentia creamish, tubular, entering into ductus ejaculatorius duplex beyond middle towards accessory gland; ductus ejaculatorius duplex creamish, straight; primary simplex divided into two sections, section-I translucent, curved, section-II milky-opaque, highly curved; constrictor muscular area with cuticular simplex opaque, curved; cuticular

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tube opaque, entering into aedeagus apically, not modified into bulbous ejaculatorius; accessory gland opaque, free, straight, throughout, transparent at tip.

**Table 4: Morphometry of internal male reproductive organs of *Hypocala deflorata* (Fabricius)**

S. No.	Organ	Length (mm)	Intraspecific range in length (mm)	Width (mm)	Intraspecific range in width (mm)
1.	Testis	0.70	0.68-0.72	0.75	0.73-0.77
2.	Seminal Vesicle - I	0.91	0.89-0.92	0.14	0.12-0.16
3.	Seminal Vesicle - II	0.83	0.81-0.83	0.47	0.45-0.49
4.	Vasa deferentia	4.25	4.23-4.28	0.08	0.07-0.09
5.	Ductus ejaculatorius duplex	4.58	4.56-4.60	0.25	0.23-0.27
6.	Primary simplex	44.74	44.70-44.78	-	-
	Section – I	37.58	37.56-37.60	0.25	0.23-0.27
	Section – II	7.16	7.14-7.18	0.33	0.31-0.35
7.	Constrictor muscular area	1.75	1.73-1.77	0.25	0.23-0.27
8.	Cuticular tube	0.14	0.12-0.16	0.12	0.11-0.13
9.	Accessory gland	16.08	16.03-16.10	0.14	0.12-0.15

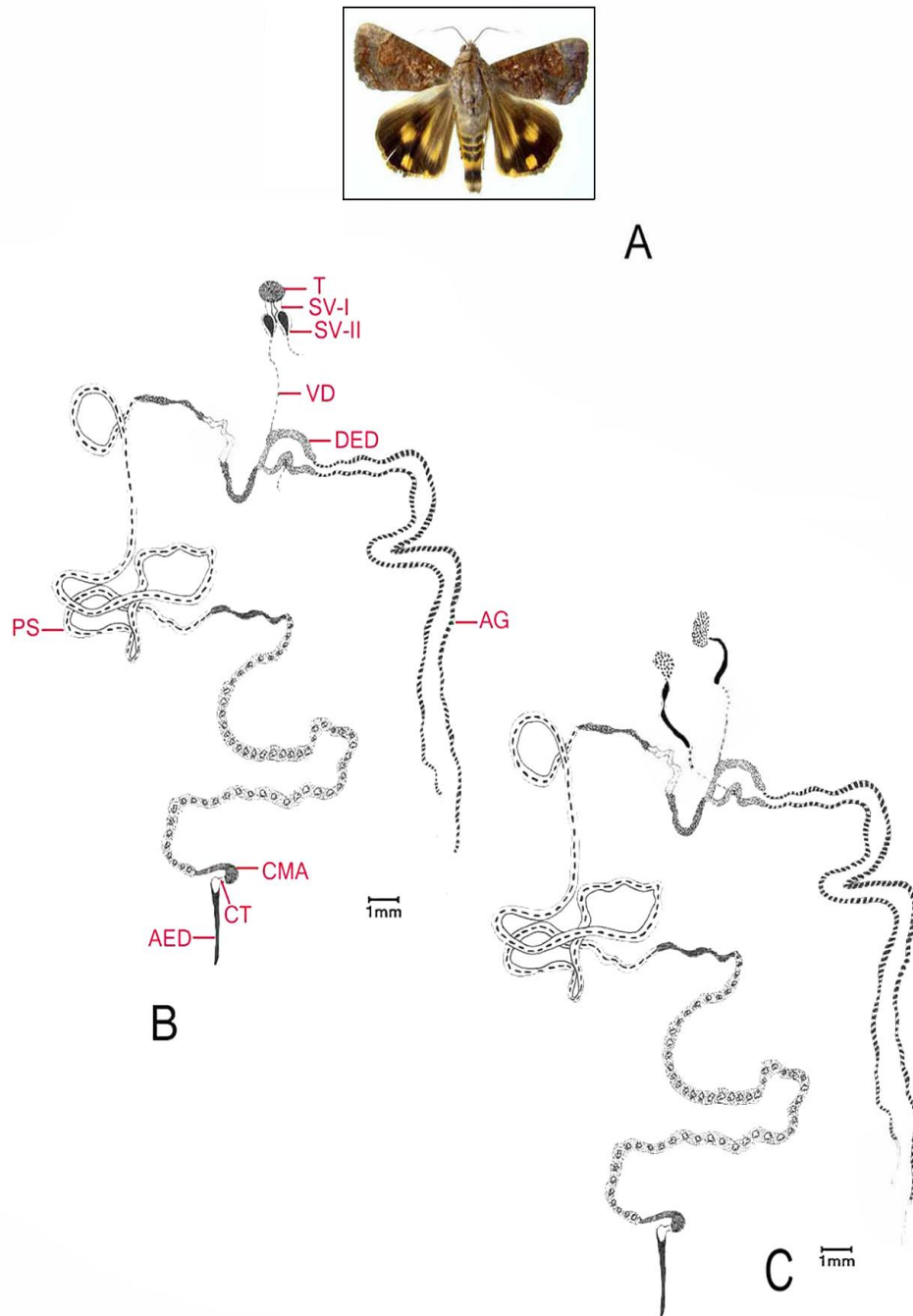
**Table 5: Morphometry of internal female reproductive organs of *Hypocala deflorata* (Fabricius)**

S. No.	Organ	Length (mm)	Intraspecific range in length (mm)	Width (mm)	Intraspecific range in width (mm)
1.	Common terminal filament	6.20	6.18-6.22	0.06	0.05-0.08
2.	Egg tube	21.26	21.22-21.28	0.36	0.34-0.38
3.	Pedicel	-	-	-	-
4.	Lateral oviduct	1.06	1.04-1.08	0.40	0.38-0.42
5.	Common oviduct	0.80	0.78-0.82	0.20	0.18-0.22
6.	Infundibulum	0.09	0.08-0.10	0.09	0.08-0.10
7.	Spermathecal duct	1.46	1.44-1.48	0.10	0.09-0.11
8.	Utriculus	1.13	1.11-1.15	0.13	0.11-0.15
9.	Lagena	0.60	0.58-0.62	0.44	0.42-0.46
10.	Spermathecal gland	11.53	11.50-11.55	0.12	0.11-0.14
11.	Corpus bursae (diameter)	5.40	5.38-5.43	-	-
12.	Ostium bursae (diameter)	0.53	0.51-0.55	-	-
13.	Ductus bursae	3.46	3.44-3.48	0.20	0.18-0.22
14.	Ductus seminalis	3.53	3.51-3.55	0.11	0.10-0.12
15.	Bulla seminalis	1.06	1.04-1.08	0.46	0.45-0.48
16.	Accessory gland reservoir duct	0.33	0.31-0.35	0.11	0.09-0.12
17.	Common Accessory gland reservoir	0.33	0.31-0.35	0.40	0.38-0.42
18.	Lateral Accessory gland reservoir	0.86	0.84-0.88	0.46	0.44-0.48
19.	Accessory gland	10.20	10.17-10.23	0.13	0.11-0.15
20.	Vestibulum	0.14	0.12-0.16	0.34	0.32-0.36
21.	Vagina	0.22	0.20-0.24	0.33	0.32-0.36

**Female reproductive system :** Common terminal filament creamish, curved; ovaries creamish, possessing four egg tubes on each side; eggs transparent, ellipsoidal anteriorly, opaque, rounded posteriorly; pedicel absent; lateral oviduct transparent, filled with eggs; common oviduct opaque, with eggs; infundibulum rounded; spermathecal duct creamish, straight; spermatheca bilobed i.e. utriculus

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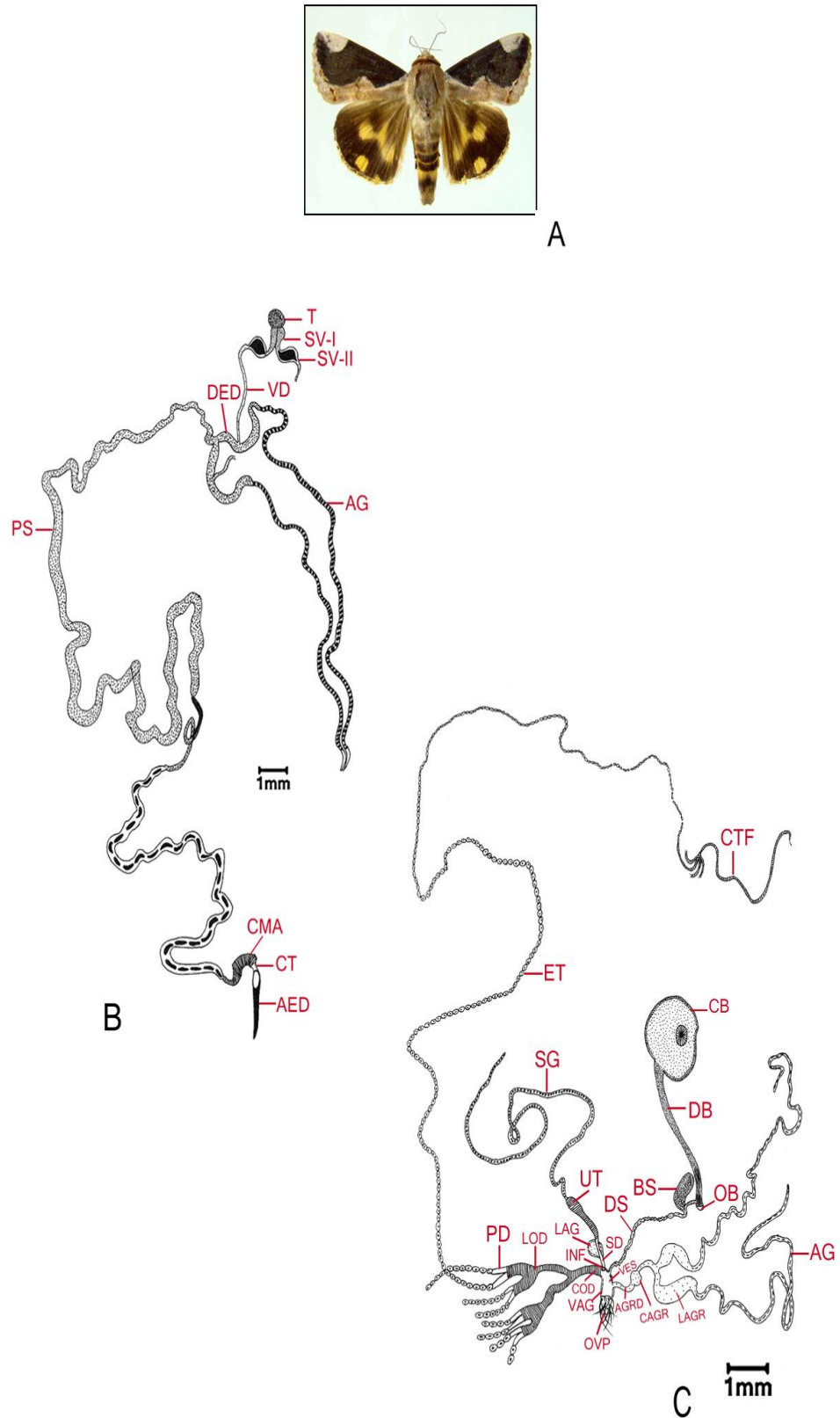
opaque, tubular; lagena translucent, rounded; spermathecal gland opaque, curved, not bifurcated at tip; corpus bursae creamish yellow, rounded, sclerotised; signum dark brownish, dotted, conical; ductus bursae translucent brownish, weakly sclerotised; ostium bursae dark brownish, sclerotised; ductus seminalis translucent, straight, arising from ductus bursae; bulla seminalis opaque, balloon shaped; accessory gland reservoir duct transparent, straight; common accessory gland reservoir translucent, bulb shaped; lateral accessory gland reservoir transparent, globular; accessory gland transparent, curved, arising from tip of reservoir; vestibulum translucent; vagina translucent.



**Figure 1: A. *Hypocala sabstura* Guenee; B. Male reproductive system; C. Male reproductive system with two separated testes**

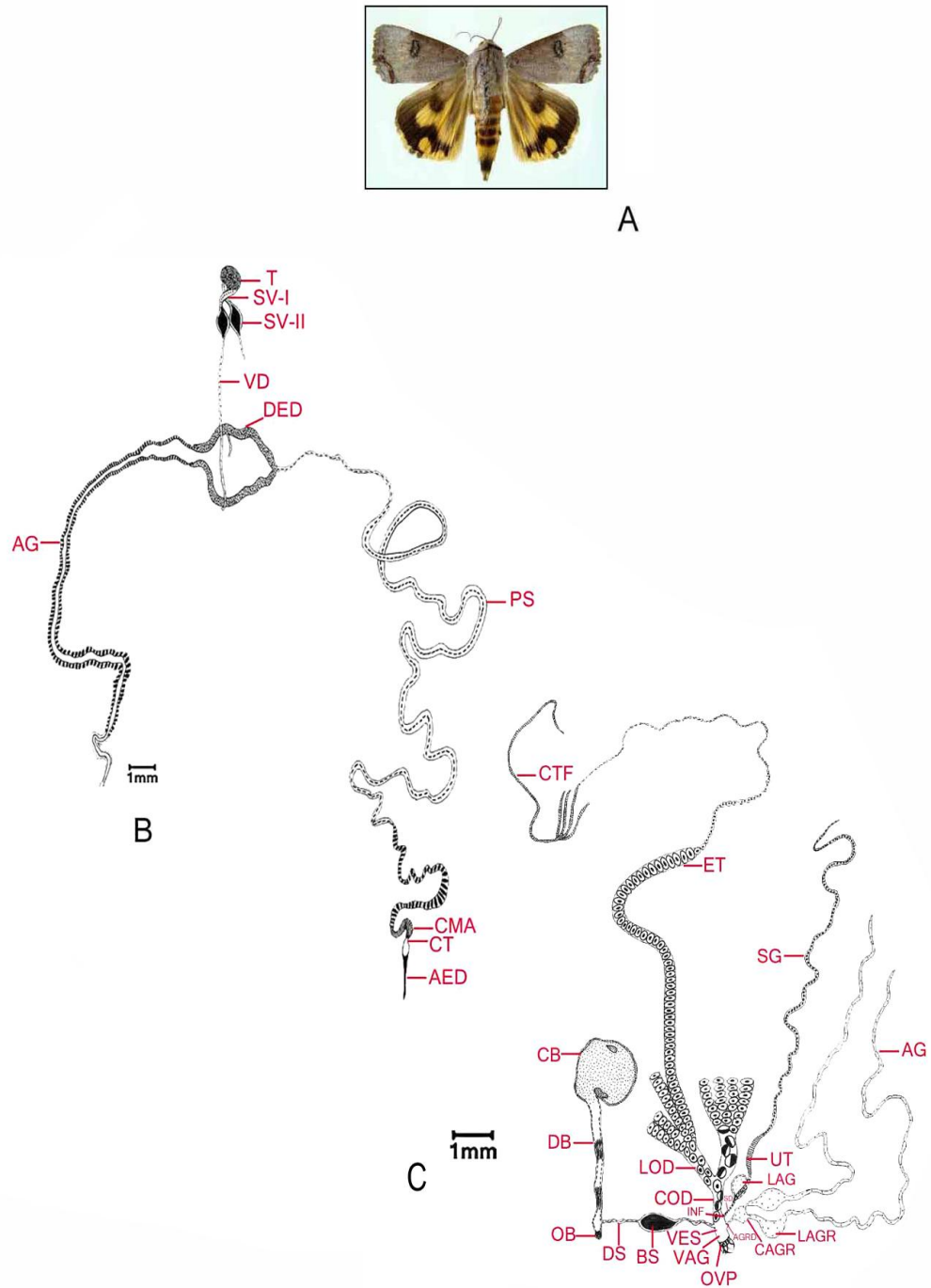


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**Figure 2: A. *Hypocala rostrata* (Fabricius); B. Male reproductive system; C. Female reproductive system**

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**Figure 3: A. *Hypocala deflorata* (Fabricius); B. Male reproductive system; C. Female reproductive system**

**Wing expanse:** 38 mm.

**Old distribution:** E. and S. Africa; N.W. Himalayas; Canara; Nilgiris.

**Material Examined:**

Solan: Sairighat, 24.ix.05, 1♂.

Shimla: Kharapathar, 21.vi.06, 1♂.

Kangra: Balakrupi, 8.vii.06, 2♂♂.



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