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New distributional records of *Eudocima* Billberg, 1820 (Lepidoptera : Erebidae : Calpinae) from Gangetic Plains (India)

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Abstract

Genus *Eudocima* Billberg is represented by 11 species from India. Four species viz., *Eudocima homaena* (Hübner), *Eudocima hypermnestra* (Stoll), *Eudocima materna* (Linnaeus) and *Eudocima phalonia* (Linneaus) are collected and studied for the first time from Bihar and Jharkhand. External genitalia of all the studied species has been illustrated and studied. A checklist of Indian species of *Eudocima* is provided.

Keywords: Bihar, Erebidae, *Eudocima*, Jharkhand, New Range Records, Taxonomy

Introduction

Genus *Eudocima* Billberg was established for its type-species *Phalaena salaminia* Cramer from China. Members of this genus are commonly known as fruit piercing moths. Adult moths of this genus have strong proboscis for piercing and sucking fluids of different fruits (Bhumannavar and Viraktamath, 2012). Diagnostic attributes of the genus were discussed in detail by Holloway (2005), whereas, the information on genitalic studies of the Indian species is still lacking. Presently, the genus is known by a total of 50 species from the world, out of which only 11 species are known from India (Holloway, 2005; Zaspel and Branham, 2008, 2008a; Subhalaxmi *et al.,* 2011; Sivasankaran and Ignacimuthu, 2014; Sivasankaran *et al.,* 2017). In this manuscript, four species viz., *Eudocima homaena* (Hübner), *Eudocima hypermnestra* (Stoll), *Eudocima materna* (Linnaeus) and *Eudocima phalonia* (Linneaus) have been collected and studied from Bihar and Jharkhand. This also confirms distributional range of all four species from Gangetic plains. Genitalia of studied species are interfered and illustrated in this paper. A checklist of *Eudocima* species from India is also provided.

Material and Methods

Collection surveys were conducted during 2014 to 2018 in different localities of Bihar & Jharkhand. The collection of adult moths were made with the help of vertical sheet light trap and the collected specimens were killed with the help of ethyl acetate vapours and processed as per standard techniques in Lepidopterology (Holloway *et al.*, 2001). Dry preservation is done in fumigated entomological boxes and stored in the insect cabinets in the Entomological collections, Zoological Survey of India, GPRC, Patna. Collected samples were identified with the help of relevant literature (Hampson, 1894; Zilli and Hogenes, 2002; Holloway, 2005; Kononenko and Pinratana, 2013; Singh and Ahmad, 2017).

Systematic Account

Genus ***Eudocima*** Billberg, 1820

Eudocima Billberg, 1820; *Enum. Ins. Mus. Billb.*1820: 85
Type species*: Phalaena salaminia* Cramer, by monotypy

1. *Eudocima materna* (Linnaeus, 1767)
Phalaena materna Linnaeus, 1767; *Syst. Nat.* (Edn 12), **1**(2): 840

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Material examined: India: Bihar, Patna, ZSI Campus (25°35'10.42" N; 85°10'05.19" E; Alt.- 169 ft.), 02.viii.2017–01 ex (Coll.-K. Kaustubh), 30.ix.2018-01 ex (Coll.-R. Joshi); Patna, Sanjay Gandhi Biological Park (25°35'57.11" N; 85°05'56.59" E; Alt.- 200 ft.), 27.ix.2015-01 ex (coll.- J. Ahmad); Gaya, Gautam Budha WLS (24°31'29.32" N; 85°01'09.62" E; Alt.- 520 ft.), 22.viii.2017 – 01 exp. (Coll.- N. Singh and Party)

Diagnostic feature: Forewing greenish grey with three rufous spots at end of cell; with a zig-zag line in the middle. Hindwing orange with a prominent black spot and crenulated marginal black band. Male genitalia with juxta lobes flat, flap-like; Aedeagus vesica with 4-5 rows of compactly packed spines.

Distribution: Throughout India (Hampson, 1894), Uttarakhand (Smetacek, 2008), Assam, Maharashtra (Subhalaxmi *et al.,* 2011), Andhra Pradesh (Ramachandrachari and Padmanabham, 1960), Punjab, Tamil Nadu, Rajasthan (Zhang, 1994), Widespread in African, S. Palaearctic and Indo-Australian regions up to the Central Pacific (Zilli *et al.,* 2017). *Elsewhere:* Sierra Leone, Zimbabwe, Sri Lanka, Australia, Fiji, New Zealand, Venezuela, Widespread in old world tropics (Zhang, 1994).

Host Plant: Mangifera indica (Mango), *Punica granatum (Pomegranate), Rhigiocarya racemifera, Tinospora cordifolia* (Giloy), *Musa paradisiaca* (Banana), *Malus pumila (Apple), Citrus, Solanum lycopersicum* (Tomatoes), *Rhigiocarya racemos, Lycopersicon.* (Zhang, 1994; Robinson *et al*., 2001).

Remarks: The species is recorded for the first time from Bihar and confirms first record from the state.

2. *Eudocima phalonia* (Linneaus, 1763)
Phalaena phalonia Linnaeus, 1763; *Amoenitates Acad.,* **6**: 411

Material examined: India: Jharkhand, Dhanbad, Topchanchi WLS (23°55'15.36" N; 86°10'55.54" E; Alt.- 972 ft.), 06.ix.2016 – 01 ex; Hazaribagh WLS, Rajderwa (24°08'30.25" N; 85°22'53.01" E; Alt.- 1667 ft.), 04.x.2016 - 01 ex, 11.ix.2015 – 01 ex, 03.ix.2016 – 02 ex (Coll.- N. Singh and Party); Bihar, VTR, Govardhana (VTR- 27°19.26' N; 84°18.48' E), 14.x.2017 – 01ex; Mangooraha (VTR- 27°19.21' N; 84°27.92' E), 17.x.2017 – 02exs; Bhediyari (27°19.34' N; 83°53.06' E), 08.x.2017 – 01 ex, 20.iii.2017 – 01 ex (Coll.- N. Singh & Party); Gautam Budha WLS, Watch Tower 2 (24°31'29.32" N; 85°01'09.62" E; Alt.- 520 ft.), 22.viii.2017 – 02 exs (Coll.- N. Singh & Party), 06.viii.2018 – 01exs (Coll.- R. Joshi & Party); Pant WLS, Rajgir, Mrigvihar (24°59'32.08" N; 85°25'23.27" E; Alt.- 539 ft.), 28.viii.2018 – 03 exs (Coll.- R. Joshi and Party).

Diagnostic feature: This species also shows sexual dimorphism**.** Adult brownish. Forewing of male with indistinct paler lines and striae having median inter spaces. Hindwing yellow with a broad marginal brown band at apex and a broad kidney shaped spot below cell. Male genitalia with juxta arms long and broad; Aedeagus vesica with a cockscomb like structure bearing several tightly packed spines.

Distribution: India: Madhya Pradesh (Rakshpal 1945); Uttarakhand (Smetacek 2008); Punjab, UP, Tamil Nadu (Zhang 1994). *Elsewhere:* China, Indonesia, Korea, Japan, New Guinea, Australia, New Zealand (Shubhalaxmi *et al.,* 2011), Sierra Leone, Ghana, Nigeria, Zimbabwe, India, Sri Lanka, Thailand, Vanuatu, New Caledonia, Tonga, Western Samoa, Fiji, Philippines, Papua New Guinea, Australia (Queensland), USA (Hawaii) (Zhang, 1994), African tropics across the Oriental, SE Palaearctic and Australian regions well into the Pacific (Zilli *et al.,* 2017).

Host Plant: Anacardium occidentale (Cashew), *Legnephora moorei, Citrus, grapes, Dimocarpus longana* (Leechi), *Mangifera indica, Carica papaya* (Papaya),*Anamirta cocculus, Cissampelos pareira, Cocculus laurifolius, Cyclea peltata, Diploclisia glaucescens, Stephania japonica, Tiliacora acuminata, Tiliacora triandra, Tinospora cordifolia* (Giloy), *Tinospora crispa, Tinospora sinensis, Musa paradisiaca, Malus pumila* (Apple), *Mitragyna diversifolia, Theobroma cacoa, Cissus quadrangularis*. (Zhang, 1994; Robinson *et al*., 2001).

Remarks: The species is recorded for the first time from Bihar and Jharkhand states of India.

3. *Eudocima hypermnestra* (Stoll, [1780])
Phalaena hypermnestra Stoll, [1780]; in Cramer, *Uitl.Kapellen.,* 4(26b-28): 69

Material examined: India: Jharkhand, Dalma WLS, Pindrabera (22°53'37.18" N; 86°11'47.00" E; Alt.- 2114 ft.), 08.x.2015 – 01 ex. (Coll.- N. Singh and Party).

Diagnostic feature: Forewing yellow-green with an oblique interrupted rufous line from apex to centre of the inner margin. Hind wing with two prominent black spots near anal angle. Male genitalia with a pair of thin juxta processes reaching almost the tip of uncus. Aedeagus vesica with a pair of tightly packed spines.

Distribution: Throughout India (Hampson, 1894), Maharashtra (Shubhalaxmi *et al.,* 2011), Tamil Nadu (Sivasankaran *et al.,* 2017). *Elsewhere:* Sri Lanka, Thailand (Zhang. 1994).

Host Plant: Mangifera indica (Mango), Cyclea peltata, Stephania japonica, Tinospora cordifolia (Giloy), Citrus, Dimocarpus longan (Leechi) (Zhang, 1994; Robinson *et al*., 2001).

Remarks: The species is recorded for the first time from Jharkhand and confirms first record from the state.

4. *Eudocima homaena* (Hübner, [1823] 1816)
Othreis homaena Hübner, [1823]; *Verz.bek. Schmett.*, (17): 264

Material examined: India: Jharkhand, Chatra, Itkhori (24°12'23.43" N; 84°52'20.74" E; Alt.- 1446 ft.), 18.x.2014 – 01 ex. (Coll.- N. Singh and Party).

Diagnostic characters: Sexual dimorphism is common in this species. Females have a broad green streak in middle of forewings which runs from near base of the wing to post medial line. Males lack this broad band. Female genitalia have elongate corpus bursae with corrugations.

Distribution: India: Karnataka (Bhumannavar and Viraktamath, 2001); Andhra Pradesh (Ramachandrachari and Padmanabham, 1960), Uttarakhand (Smetacek, 2008), Tamil Nadu (Sivasankaran *et al.,* 2017), Rajasthan (Zhang, 1994). *Elsewhere:* Sri Lanka, China, Myanmar, Malaysia, Indonesia, Singapore, Philippines (Shubhalaxmi *et al.,* 2011), Oriental tropics (Zhang, 1994), E. Palaearctic and Oriental regions from India and Sri Lanka also Sulawesi, Lombok, Flores and Timor (Zilli *et al.,* 2017).

Host Plant: Achyranthes aspera, Punica granatum (Pomegranate), Cyclea peltata, Tiliacora acuminata, Psidium guajava (Guava), Citrus (Zhang, 1994; Robinson *et al*., 2001).

Remarks: A single female specimen was collected from Jharkhand and represents first record from the state.

A Checklist of *Eudocima* species from India

1. *Eudocima cajeta* (Cramer, 1775)
Phalaena cajeta Cramer, [1775]; *Uitl. Kapellen* 1 (1-7): 48, (8):152

Distribution: Tamil Nadu (Sivasankaran *et al.,* 2017); Indian sub-region, Vietnam, Thailand (Holloway, 2005)

2. *Eudocima homaena* (Hübner, [1823] 1816)
Othreis homaena Hübner, [1823]; *Verz.bek. Schmett.* (17): 264

Distribution: India: Jharkhand (Present study), Karnataka (Bhumannavar and Viraktamath, 2001); Andhra Pradesh (Ramachandrachari and Padmanabham, 1960), Uttarakhand (Smetacek, 2008), Tamil Nadu (Sivasankaran *et al.,* 2017), Rajasthan, Oriental tropics (Zhang, 1994). E. Palaearctic to Oriental region (Zilli *et al*., 2017)

3. *Eudocima hypermnestra* (Stoll, [1780])
Phalaena hypermnestra Stoll, [1780]; in Cramer, *Uitl.Kapellen,* **4**(26b-28): 69

Distribution: Throughout India (Hampson, 1894), Jharkhand (Present study), Maharashtra (Shubhalaxmi *et al.,* 2011), Tamil Nadu (Sivasankaran *et al.,* 2017); Sri Lanka, Thailand (Zhang, 1994).

4. *Eudocima materna* (Linnaeus, 1767)
Phalaena materna Linnaeus, 1767; *Syst. Nat.* (Edn 12) **1**(2): 840

Distribution: Throughout India (Hampson, 1894), Bihar (Present study), Uttarakhand (Smetacek, 2008); Assam, Maharashtra (Subhalaxmi *et al.,* 2011), Andhra Pradesh (Ramachandrachari and Padmanabham 1960); Punjab, Tamil Nadu, Rajasthan (Zhang, 1994); Sierra Leone, Zimbabwe, Sri Lanka, Australia, Fiji, New Zealand, Venezuela, Widespread in old world tropics (Zhang, 1994), African, Palaearctic & Indo-Australian (Zilli *et al.,* 2017).

5. *Eudocima phalonia* (Linneaus, 1763)
Phalaena phalonia Linnaeus, 1763; *Amoenitates Acad.* **6**: 411

Distribution: India: Bihar, Jharkhand (Present study), Madhya Pradesh (Rakshpal, 1945); Uttarakhand (Smetacek, 2008); Punjab, UP, Tamil Nadu (Zhang,

1994); Sierra Leone, Ghana, Nigeria, Zimbabwe, India, Sri Lanka, Thailand, Vanuatu, New Caledonia, Tonga, Western Samoa, Fiji, Philippines, Papua New Guinea, Australia (Queensland), USA (Hawaii) (Zhang 1994), African tropies, Oriental, SE Palaearctic, Australian region (Zilli *et al*., 2017)

6. *Eudocima sikhimensis* (Butler, 1895)
Adris sikhimensis Butler, 1895; *Ann. Mag. nat. Hist.* (6) **15**(85): 126

Distribution: India: Darjeeling (Butler, 1895), Tamil Nadu (Sivasankaran *et al.,* 2017), Indian Sub-region, Thailand, Sundaland (Holloway, 2005)

7. *Eudocima tyrannus* (Guenée, 1852)
Ophideres tyrannus Guenée, 1852; *Hist. nat. Ins., Spec. gén. Lépid.* 7 (Noct. 3): 110

Distribution: India: Throughout Himalaya (Hampson, 1894), West Bengal, Goa, Karnataka (Subhalxmi *et al.,* 2011); Russia (Zaspel and Brahman 2008)

8. *Eudocima salaminia* (Cramer, 1777)
Phalaena salaminia Cramer, [1777]; *Uitl. Kapellen* **2**(9-16): 117

Distribution: India: Throughout India (Hampson 1894), Maharastra (Subhalaxmi *et al.,* 2011), Uttarakhand (Smetacek, 2008), Indo-Australian tropics to Samoa and Tonga (Holloway, 2005)

9. *Eudocima cocalus* (Cramer, 1777)
Phalaena cocalus Cramer, [1777]; *Uitl. Kapellen* **2**(9-16): 59

Distribution: India: Tamil Nadu (Sivasankaran *et al.,* 2017)]; N.E. Himalaya, Sundaland and east to Australia and the Solomons (Holloway, 2005)

10. *Eudocima* [*Khadira*] *aurantia* (Moore, 1877)
Ophideres aurantia Moore, 1877; *Proc. zool. Soc. Lond.* **1877**(3): 607

Distribution: India: Andamans (Moore, 1877), Tamil Nadu (Sivasankaran *et al.,* 2017); Sri Lanka, India, China, Andamans, Sundaland, Sulawesi, Seram, New Guinea, Queensland, Solomons (Holloway, 2005)

11. *Eudocima* [*Rhytia*] *discrepans* (Walker, [1858])
Ophideres discrepans Walker, [1858]; *List Spec. Lepid. Insects Colln Br. Mus.* **13**: 1227

Distribution: N.E. Himalaya, W. China, Thailand, Sundaland (Holloway, 2005)

Results and Discussion

Adult Fruit piercing moth *Eudocima* are the major pests of many fruit crops (Banziger, 1982; Leong and Kueh, 2011). A total of 11 species of *Eudocima* are reported from Indian region. Current study results in collection of four Indian species reported from different localities of Bihar and Jharkhand states of Gangetic Plains which covers major agro-ecosystems. Both these states have cultivation of Tomato (*Solanum lycopersicum*), Grapes (*Vitis vinifera*), Leechi (*Litchi chinensis*), Mango (*Mangifera indica*), Papaya (*Carica papaya*), Banana (*Musa acuminata*), Guava (*Psidium guajava*), etc. Some plant species like Giloy (*Tinospora cordifolia*) is also very common among the local vegetation's in the areas. As *Eudocima* is well established pest of above mentioned plants, it is obvious that the moths must be damaging these crops. As study of these moths on such crops from this region are still lacking, so, their extent of damage to these plants is a matter of concern for agricultural scientists. Reporting of these fruit piercing moths from the region, underline the need of further studies on the possible damages of cash crops by these insects and to design suitable measures for their management.

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References

Banziger, H. 1982. Fruit-piercing moths (Lep., Noctuidae) in Thailand: a general survey and some new perspectives. Mitteilungen der Schweizerischen Entomologischen Gesellschaft, **55**: 213–240.

Bänziger, H. 1983. A taxonomic revision of the fruit piercing and blood sucking moth genus *Calyptra* Ochsenheimer (Calpe Treitschke) (Lepidoptera: Noctuidae). *Entomologica Scandinavica*, **14**(1): 467-491.

Bhumannavar, B. S. and Viraktamath, C. A. 2012. Biology, ecology and management of fruit piercing moths (Lepidoptera: Noctuidae). *Pest Management in Horticultural Ecosystems*, **18**(1): 01-18.

Hampson, G.F. 1894. The Fauna of British India including Ceylon and Burma. Moths, Vol. II: 1-609, Published by Taylor and Francis Ltd., London.

Holloway, J.D., Kibby, G. and Peggie, D. 2001 [2000]. *The Families of Malesian Moths and Butterflies*. Fauna Malesiana Handbook 3. Leiden: E.J. Brill.

Holloway, J.D. 2005. The Moths of Borneo: family Noctuidae, subfamily Catocalinae. *Malay. Nat. J.*, **58**: 1-529.

Kononenko, V. S. and Pinratana, A. 2013. Moth of Thailand Vol. 3, Part 2. Noctuoidea.An illustrated Catalogue of Erebidae, Nolidae, Euteliidae and Noctuidae (Insecta, Lepidoptera) in Thailand: 1-625, published by Brothers of St. Gabriel in Thailand. Bangkok.

Leong, Stephen Chan Teck and Kueh, Roland Jui Heng 2011. Seasonal Abundance and Suppression of Fruit-Piercing Moth Eudocima phalonia (L.) in a Citrus Orchard in Sarawak. *The Scientific World Journal*, **11**: 2330–2338.

Rakshpal, R. 1945. Citrus fruit-sucking moths and their control. *Indian Farming*, **6**: 441-443.

Ramachandrachari, C. and Padmanabham, V. 1960. An assessment of incidence of different fruit moths on sweet oranges in Cuddapah district. *Andhra Agricultural Journal*, **7**(2): 121-128.

Robinson, G.S. 1976. The preparation of slides of Lepidoptera genitalia with special reference to Microlepidoptera. *Entomologist's Gazette*, **27**: 127-132.

Robinson, S. G., Ackery, R. P., Kitching, J. I., Beccaloni, W. G. and Hernandez, M. L. 2001. Hostplants of the moth and butterfly caterpillars of the Oriental Region: 1-744, Published by Department of Entomology, The Natural History Museum, Cromwell Road, London.

Shubhalaxmi, V., Kendrick, C. R., Vaidya, A., Kalagi, N. and Bhagwat, A. 2011. Inventory of moth fauna (Lepidoptera: Heterocera) of the Northern Western Ghats, Maharashtra, India. *Journal of the Bombay Natural History Society*, **108**(3): 183-205.

Sivasankaran, K. and Ignacimuthu, S. 2014. A report of erebidae (lepidoptera: noctuoidea) from the Tamil Nadu part of the Western Ghats, India. *Journal of the Bombay Natural History Society*, **111**(3): 193-209.

Singh, N. and Ahmad, J. 2017. A preliminary list of Lepidopteran insects from Palkot Wildlife Sanctuary, Jharkhand (India). *Journal of Entomology and Zoology Studies*, **5**(3): 654-661.

Sivasankaran, K., Anand, S., Pratheesh, M. and Ignacimuthu, S. 2017. Checklist of the superfamily Noctuoidea (Insecta, Lepidoptera) from Tamil Nadu, Western Ghats, india. *Checklist,* **13**(6): 1101-1120.

Smetacek, P. 2008. Moths recorded from different elevations in Nanital district, Kumaon Himalaya, India. *Bionotes*, **10**(1): 5-15.

Zaspel, J.M. and Branham, M.A. 2008. An annotated list of the fruit-piercing moth genus *Eudocima* Billberg, 1820 (sensu Poole) with descriptions of four new species. *Quadrifina*, **47**: 1-15.

Zaspel, J.M. and Branham, M. A. 2008a. World Checklist of Tribe Calpini (Lepidoptera: Noctuidae: Calpinae) Insecta Mundi, **47**: 1-15.

Zhang, C.B. 1994, Index of Economically Important Lepidoptera: 1-599, Published by Department of Crop Protection, Cab International, Wallingford, UK.

Zilli, A. and Hogenes, W. 2002. An annotated list of the fruit–percing moth genus *Eudocima* Billberg, 1820 (sensu Poole, 1989) with description of four new species (Lepidoptera: Noctuidae, Catocalinae). *Quadrifina*, **5**: 153–207.

Zilli, A., Brou, V.A., Klem C. and Zaspel, J. 2017. The *Eudocima* Billberg, 1820 of the Australian Region (Lepidoptera: Erebidae). In Telnov D. (ed.), Biodiversity, Biogeography and Nature Conservation in Wallacea and New Guinea **3**: 631-655.

Plates

1

2

3

4

Plate – I, *Eudocima* Adults: 1, *Eudocima materna* (Linnaeus, 1767);
2, *Eudocima phalonia* (Linneaus, 1763); 3, *Eudocima hypermnestra* (Stoll, 1780);
4, *Eudocima homaena* (Hübner, [1823] 1816)

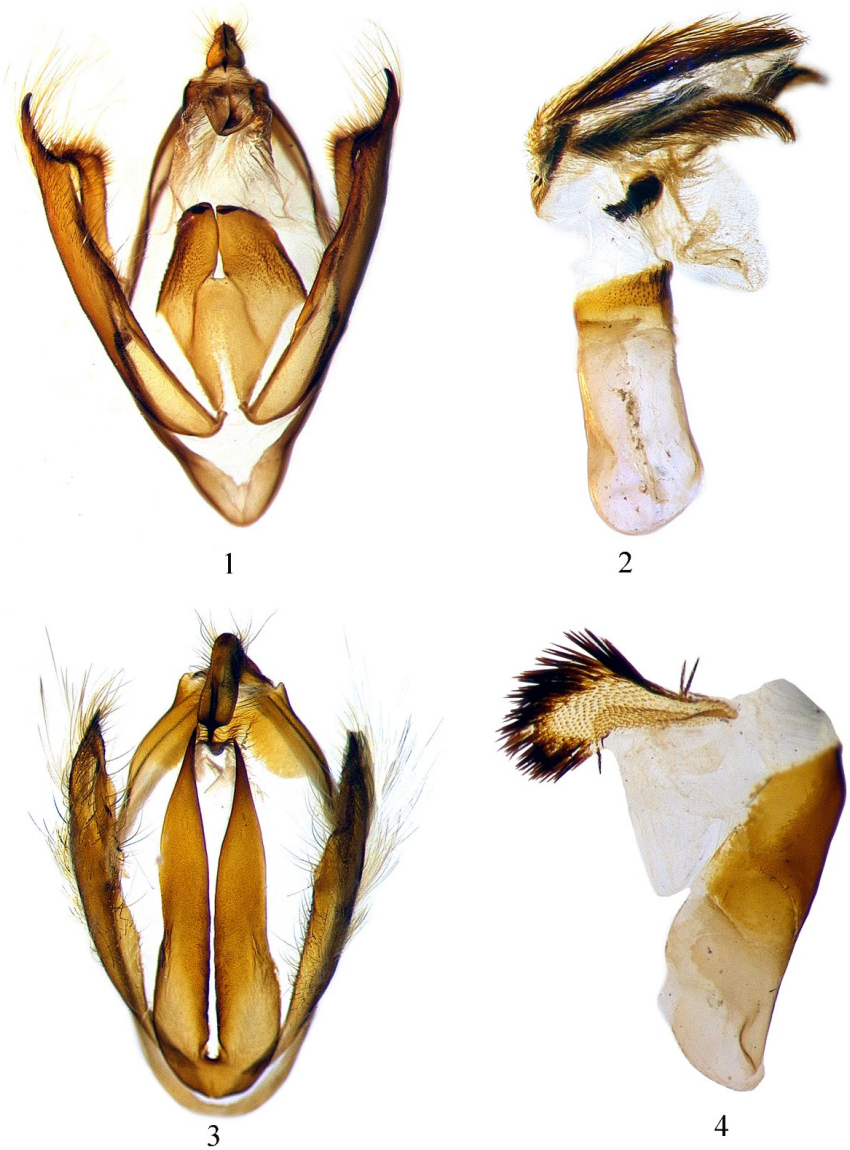

Plate – II, Male genitalia: 1 & 2, *Eudocima materna* (Linnaeus, 1767); 3 & 4, *Eudocima phalonia* (Linneaus, 1763)

Plate – III, Male and Female genitalia: 1,2 & 3, Male genitalia *Eudocima hypermnestra* (Stoll, 1780); 4, Female genitalia *Eudocima homaena* (Hübner, [1823] 1816)