CHAPTER - IV

TAXONOMY OF WILD SILKMOTHS
Taxonomy of wild silkmoths

Taxonomy plays a very significant role in the field of applied biology including public health, national defense, pest management, forestry, environment problems, wild life management, nutritional science, forensic science and several other fields in identifying the species. Identification of species is first in any experimental work. Hence taxonomists are must. The subject taxonomy was treated unrewardedly and stepmotherly by the financial agencies for long time in India. Secondly, molecular biology and biotechnology have attracted the attention of students. Hence, taxonomy has never been an attractive profession for the students but, now the picture is changed. Funding agencies are providing lot of funds for doing research on taxonomy because, taxonomists need in Research Institutes, Museums, Central and Government agencies, Industries, Zoos, Universities, etc. In fact, taxonomists are largely involved in designing and implementing control programmes of pest and disease effectively than other subject experts.

Taxonomy and biological & biotechnological sciences are interlinked. It helps in understanding evolutionary approaches of the Species and Guide the explorations for native and exotic species for fruitful use.

In the entire animal kingdom insects forms the largest group. They are divided into 40 Orders by Martynov (1938) and 30 Orders by Imms (1940) that are in turn broadly grouped into wingless (silverfish) and winged insects (bugs, butterflies, moths, beetles, flies etc) (Sathe ,2005). Insects are the only invertebrates which can fly and seem to appeared around 360 million years ago, around much before the dianosaurs appears on the earth. During a great insect 'boom' in the lush, gloomy and fern forests of the world. Insects are of the most successful groups of animal. They have significantly managed to survive the onslaught of Homo sapiens. Following the evolution of flowering plants, moths and butterflies (Order: Lepidoptera) were among the last to arrive on the evolutionary scene around 160 million years ago. According to Kehimkar (1997) there are about 25000 known species of butterflies and over, 1,20,000 moths. The combine number of moths and
butterflies as Order: Lepidoptera is second to largest Order: Coleoptera (beetles and weevils) of class insecta. Much of the evolutionary history of these insects is guess-work, however, very few fossil records that have been found shown that the structure and pattern of the wing veins of the moths that existed around 30 million years ago and appear very similar to those found today. Some primitive moths existing even today are believed to have a common ancestor with caddisflies. Such types of little moths have no proboscis for sucking liquid food but, instead have biting jaw to feed on pollen. Very strikingly indicating the early moths bad biting mouth parts, some moths like Atlas and Tasar have no mouth at all as they do not feed in their very short life span of two weeks as adults (Kehimkar, 1997).

Moths belong to Order: Lepidoptera. They differ from butterflies by absence of clubbed antennae and dull colouration than butterflies, and mostly they fly by night. Very typically, they keep their wings parallel on the sitting substrate. If mouth parts present in moth, are modified into long coiled tongue called as proboscis. The moth shows distinct stages of its life cycle viz, egg, larva, pupa and adult. The eggs of moths vary greatly in shape, size and colour. Tasar and Moon moths lay them in small clusters on the leaves of favourite food plants.

Moths are a distinct taxonomical group of the Order: Lepidoptera. Moths in general shows following characteristics:

1. Medium to large sized
2. Covered with overlapping flat scales forming colour patterns.
3. Mouth parts modified into a coiled sucking proboscis.
4. 2 pairs of wings present
5. No cerci present.

According to Mani (1993) the Order Lepidoptera is divided into three suborders namely,
1. Jugatae,
2. Rhopalocera and
3. Frenatae
Jugatae: In Jugate wings are interlocked by jugum and venation of fore and hind wings are similar.

In Rhopalocera antennae are knobbed at tip or thickened before tip, wings are without frenulum but, with strongly arched and butterflies are included under this suborder.

In Frenatae antennae are simple or variable, rarely swollen at the tip and wings with frenulum.

The suborder Jugatae is divided into following super families, Micropterygoidea and Hepialoidea.

The sub Order: Frenatae contains following super families namely, Cossocideia
Castnioidea
Zygaenoidea
Incurvarioidea
Nepticuloidea
Zygaenoidea
Pyralidoidea
Sphingoidea
Elachistoidea
Gelechoidea
Yponomeutoidea
Tortricoidea
Pterophoroidea
Tineoidea
Uraniodea
Geometroidea
Drepanoidea
Noctuoidea
Saturnioidea
Bombycoidea
and Rhopalocera contain two superfamilies namely Hesperioidea and Papilionoidea. The super family Saturnioidea has a great economic importance since the individuals produce silk. The super family Saturnioidea contain only one family namely, Saturniidae. It is characterized by

1. Antennae bipectinate in both the sexes, the rami being longer in males.
2. A prominent eye spot near the centre of each wing is present.
3. Hindwings with veins Sc+R₁ diverging from the cell base M₂ (median vein) arising at or in front of middle of cell, frenulum completely absent.
4. The maxillae are absent and labial palps are small.
5. Larvae are stout and possess scoli of unequal size on all the segments.
6. Larvae are polyphagous and spin large and dense cocoons.
7. Some of the species belonging to this family over winter and complete one generation in a year whereas others are multivoltine in nature.
8. The members of this family are mostly found in tropical countries but, a few are present in temperate regions.
9. This family includes largest moths of the world having wing expanse of about 25 cm and are mostly conspicuous or brightly coloured, e.g., A. alias, A. edwardsi etc.
10. It includes non-mulberry silk producing insects such as Antheraea mylitta, A. proylei, A. roylei, A. yamamai, A. assamensis, S.c ricini, Anaphe moloneyi, A.atlas, Pachypasa otus etc. Besides, these, it also includes some non-commercial sericigenous lepidopterans like A. selene (moon moth) and C. trifenestrata (cashew caterpillar). The family Saturniidae contains two subfamilies viz, Salassinae and Saturniinae.

The subfamilies Saturniinae shows following characters.

1) Moths medium to very large sized with adult spans ranging from 7.5 to 15 cm.
2) The sub family Saturniinae is further sub divided into five tribes namely, Attacini, Saturniini, Bunaeini, Urotini and Miragonini. Out of which the two tribes viz., Attacini and Saturniini plays very important role in producing
Fig. 22: Adult moth 1. Antenna 2. Head 3. Eye 4. Thorax 5. Fore leg
9. Hyaline area
good quality cocoons. The tribe Saturniini further subdivided into following important eight genera namely,

- *Rhodinia* Staudinger,
- *Actias* Leach,
- *Saturnia* Schrank,
- *Loepa* Moore,
- *Cricula* Walker,
- *Lemaireia* Nassig & Holloway,
- *Solus* Watson and
- *Antheraea* Hubner.

Taxonomic account on Saturniidae of Indian moths indicates that different workers such as Linnaeus (1758), Fabricus (1793), Guene’s (1952) while initiating studies have named many species of Lepidoptera. However, Hampson (1976) made very significant contribution on Indian moths in Fauna of British India, moths – I, under which he described 23 families including the family Saturniidae. Under the family Saturniidae he described 3 species of the genus *Actias*, 7 species of the genus *Attacus*, 7 species of the genus *Antheraea*, 10 species of the genus *Saturnia*, 3 species of genus *Loepa*, 2 species of the genus *Salassa* and 2 species of the genus *Cricula*. All above Saturniidae species have been reported from India. While according to Brown et al., (2007) under genus *Attacus* single species, under genus *Rhodinia* two species, under genus *Actias* seven species, under genus *Saturnia* seven species, under genus *Loepa* six species, under genus *Cricula* three species, under genus *Lemaireia* two species, under genus *Solus* one species and under genus *Antheraea* five species have been described from New World Tropics and Mexico. There are about approximately one dozen described species living in Europe, one of which, the Emperor moth, occur in the British Isles and 68 described species living in North America, 42 of which reside north of Mexico and Southern California.

Recently Sathe (2007) reported 2 species of the genus *Attacus* i.e. *A.atlas* and *A. edwarsi* from the genus *Actias* he reported 2 species namely *Actias*
indica, Actius Paphia out of which Actius indica is new species reported by the author. Under the genus Antheraea Sathe (2007) reported 5 species namely A.mylitta, A.cingalesa, A.knyvetti, A.andamana and A.helferi. He also reported Saturnia anna, Laepa katinka and C. trifensta.

Hampson (1894-1919) made a significant contribution to the noctuid fauna of India. In fact, the compiling of the taxonomic account of Indian moth species (besides Burma, Bhutan and Ceylon) in I to III volumes of “Fauna of British India” is an outstanding contribution made by the author.

In past, Hampson (1976), Arora & Gupta (1979), Sathe & Pandarbale (1999, 2004, 2008), etc, studied taxonomy of moths from India. Other taxonomical workers related to genitalia of tasar moths refer to Zander (1903), Pierce (1909-1943), Snodgrass (1935), Viette (1948), Sen and Jolly (1967,1971), etc, while, ecoraces of A.mylitta have been studied by Thangavelu (1992), Alam et al., (1993), Narasimhanna (1998),Akai (1998), Satpathy & Rao(2003), Mohanty (2003),Mohan Rao et al., (2004), Kirsur & Krishna Rao (2003), Shankar Rao et al., (2004), Rout et al.(2003), Mitra &Moon (2009) etc. Up to date 7 species of genus Antheraea have been reported (Hampson, 1976; Sathe & Pandarbale, 2008) and 44 ecoraces have been reported from India (Sinha, 1998; Srivastava et al., 2003). However, no subspecies has been reported from the world. The present work will add great relevance in identification and phylogeny of the species.

MATERIALS AND METHODS

For taxonomical studies silkmoths have been collected from the fields of Western Maharashtra at 15 days interval from May to January (2005 – 2009). The moths collected have been preserved in the insect box after pinning and drying. Taxonomical observations have been made on head, thorax, abdomen and their appendages. Measurements were taken with the help of ocular meter. Cocoons collected / reared have been characterized with respect to weight, shell weight, shell ratio, length, width, peduncle length, ring diameter, filament length and filament shade.
Preparation of genitalia:

For preparation of genitalia, the hind portion of the abdomen of male moth beyond 6th segment was separated out, boiled in 5 per cent KOH solution for about 30 min and then kept over-night in the same solution. This resulted in the removal of muscles and partial bleaching of chitinous parts. KOH was neutralized by acetic acid treatment for about 30 min. The material being very big, examination of the unstained specimens in thick Canada balsam on slides under dissecting microscope was helpful in studying the genitalia. In describing the genitalia the terminology adopted was the same that of Snodgrass (1935), Sen & Jolly (1971) and Hampson (1976).
Morphological Consideration:

Morphological characteristics of a typical moth are represented in Fig. 22 to 28.

**Head (Figs. 22, 23a, 23b)**

The dorsal skeleton is divided by two transverse sutures into clypeus (2) epicranium and occiput. The epicranium provides laterally the sockets for the antennae. The clypeus is the largest plate of the three. It is more or less strongly convex especially medially. It bears at the anterior margin the labrum. The labrum is in most instance raised to a large transverse cariniform tubercle fronted over the base of the tongue (Hampson, 1902, Bell and Scott, 1976). The epistome covers the base of tongue, when normal it has a thin medial lobe and a large process at each side. The lateral processes are designated as "pilifer". The normal pilifer (5) is a curved obtuse process concave and flattened on the inner side and the inner surface with a great number of long stiff bristles which project over the base of the tongue. The genal process (2) is more or less triangular projection between the pilifer and tongue. Below the pilifer close to the tongue on each side is a short process which is the remnant of the maxillary palpus (3). It is densely clothed with long white scale. The transverse arched strip between the labial palpi is the mentun. The proboscis or tongue (4) is formed by the first pair of maxillae and consists of two halves closely applied to each other. The palpus is large broad in lateral aspect, closely contiguous to the head, and has a short mini segment.

Eyes are subglobular, never hairy, but often covered above by a kind of eye brow and below by a large tuft of hairs. Antennae is divisible into scape, pedicel and flagellum (Fig.24).

**Thorax (Fig. 25):**

Mesonotum, composed of the prescutum, scutum and postscutum is very large. The parascutum is distinctly triangular in dorsal view. The sentum (1) is widest behind and a little longer than broad. The post-scutum varies obviously in size and shape. Similar parts compose the metanotum. The
scutum (3) is divided into two halves. The postscutum (3) is always narrow. The ventral pairs of the meso and metathorax do not differ much in size. The sternum and peristernum (12) are not completely separated from one other. The peristernum is large and remains broad at the obliquely truncate upper end where it leans against the parasternum (9). This is a large plate extending obliquely dorsad and mesiad from the meral suture (13) separating the meral and sternal parts of the sternite, to the membrane connecting meso and prothorax. Between this plate and the notum the mesothoracic tegular (7) is inserted. Below the parasternum there is episternum (11), with which are fused the hyposternum (15) and the marginal strips along the coxal cavity. The meral half of the sternite is made up of the paramerum (8) and the protomerum (13), two more or less strongly convex plates, together with the large epimerum (10). A marginal strip (14), situated along the meral cavity, is separate by a more or less distinct suture from, the epimerum. The metasternite is more simplified than the mesosternite.

**Leg (Figs. 27)**

The leg comprises the coxa, trochanter, femur, tibia and tarsus. The coxa is inserted in a groove formed by sternal parts of the sternite. The trochanter (troch) is borne by the coxa and supported by coxa and is supported behind by merum. The femora always remain simple. Tibia and tarsus may have several modifications. The apex of the fore tibia is often produced into a strong process (a thorn). Tibiae are more or less spinose. The mid tibia has one pair of slender spurs but, the proximal pair very often disappears. The hind tarsus is generally longer than the midtarsus. The comb is less strongly developed. The fifth segment of all tarsi bears some stout and pale sensory hairs at the end on each side close to the apical spine, forming often a brush. There are two long bristles dorsally close to the edge, curving ventrad. The claw segment is composed of the claw (onychium), the false claw (paranychium), the pad (pulvillus) and the empodium. The empodium is a small tubercle above the pad between the claws bearing one bristle.
Wings (Fig. 26)

The veins of the wings is dealt with in the systematic section. The frenulum and retinaculum are reduced /vestigial or absent. The fore and hind wings are very variable in shape.

ABDOMEN (Fig. 22):

Moth has ten abdominal segments. The ninth and tenth of male and the eighth to tenth of female are modified. The spines stand at the edges of the segments and are found on segments 2 and 8 in the male and 2 and 7 in female. The first abdominal segments consists of a tergite (at) and a more or less triangular lateral plate, the parapleural (pp), it bears no trace of real spines. The first abdominal stigma (sti) lies free in the membrane in front of the parapleural. The second to sixth tergites are longer. The eighth tergite is small and partly (♂) or completely (♀) concealed by the seventh. The parapleura of segments 2 and 8 are membranous and bear the stigma. The sternites of the first and last segments may have modifications.

Genitalia: (Fig. 28)

The male genitalia consist of VII, VIII, IX and X abdominal tergites and sternites. Associated with these segments, there are periphallic organs, gnathos, saccus uncus, harpes and accessory harpes including a phallus complex .The VII and VIII segments are not modified in relation to the genitalia but form at least the protractile or retractile base for the copulatory apparatus and remain membranous. On the contrary, the IX and X segments are greatly modified and act as gonosomites. The IX gonosomite encircles the tip of lite abdomen and forms the base of the peripheral genital processes. It exists in the form of a simple sclerite ring, with distinct tergal and coxosternal areas of sclerotization. Mid-ventrally, its sternal portion (vinculum) is produced into a long median saccus which extends anteriorly upto the VII segment. The ventral wall of saccus is adnate with the VII and VIII sternites and strongly attached to them. Attached to the hind margin of the gonosomite (tegumen) there is a slender hook like median dorsal process called, uncus. It is projected posteriorly, the tip being attached to the hind margin of X tergum,
which is membranous. A like ventral sclerite called gnathos (sub-anal structure) is hinged basally to uncus. It lies vertically, the serrated tip ending near the rudimentary anal opening of the male. A pair of movable genital claspers (harpes) hinged to the lateral sides of the vinculum forms the most prominent part of external genitalia. Each harpes is a tri lobed structure. The smallest lobe is situated in the ventro-lateral aspect of the vinculum. The middle lobe is the longest lies in its lateral aspect. The third lobe which is little smaller than the lateral lobe occupies a dorsolateral position. The first lobes are muscular and flexible bearing numerous hairs, whereas, the dorso-lateral lobe is chitinous and bears five spines at distal extremity. A chitinous accessory harpes, hinged to the vinculum on either side below the harpes occupies a position between the lateral and dorso-lateral lobes. It is broad at the base extending to about two third of its length, the rest being in the form of a slender curved needle.

The phallus complex of *A. mylitta* consists of an unpaired phallus and various supporting structures (phallobase). The phallus includes adeagus, cornua, apodem and endophallus. The distal part of the phallus (adeagus) is a typical sclerotic-structure. It is slender with a curved and pointed tip. While its dorsal aspect is serrated, ventrally it is produced into a bow shaped plate. The middle portion of the phallus is swollen (cornua) having a small hole through which the ejaculatory duct passes into the endophallus. The apodem is a simple rod and forms the proximal part of the phallus. The phallobase is a mere inflection of the genital chamber wall forming a pocket (phallocrypt) containing the base of the adeagus and is produced as a tubular theca (phallotheca). The phallotheca is broader at the anterior side, slowly getting narrower posteriorly. Its posterior edge is attached to the proximal extremity of the adeagus, the anterior edge being fused with the anellus. The anellus is the sclerotic ring of the phallocrypt or phallotheca encircling the opening through which the adeagus passes. All these structures are associated with the mid-ventral portion of the vinculum. A pair of strong muscle bands arise each from cornua and apodem.
RESULTS

GENUS ANThERAEa HUBNEr

The genus Antheraea is erected by Hubner in 1818 on the basis of type, A. Paphia Linn, Wood- Mason (1886) subdivided the genus Antheraea into two subgenera viz., Antheraea and Antheracopsis. The genus is scattered in Africa, Japan, China, Philippines, India, Sri Lanka, Myanmar, Andaman and Java. It is characterized by fore wing with Costa incurved near base, excurved towards apex, which is rounded; cell of both wings closed. From India Hampson (1892) reported seven species under this genus and recently Sathe (2007) confirmed seven species and he add one more new species under this genus from India. No subspecies have been described under the species of this genus upto date however, 44 ecoraces have been reported from India (Srivastava et al., 2003)
KEY TO SUB SPECIES OF ANtheraeA MYLITTA

1) Anterio lateral part of fore wing blunt
   Hyaline area more or less oval ........................................ (3)
   Dorsolateral lobe three spines

2) Anterio lateral part of fore wing acute or some what pointed
   Hyaline area not circular or oval ................................. (7)
   Dorsolateral lobe two spines

3) Saccus anteriorly rounded and wider, slightly notched basally
   Adeagus knife shaped and black banded .................. A.mylitta indica
   Dorsolateral lobe bears three long spines

4) Saccus anteriorly slightly tapering ............................. (5)
   Saccus not notched basally
   Dorsolateral lobe bears three long spines
   Adeagus long, knife shaped longer and broader than indica ........
   ............................................................................. A.mylitta
   jujupi

5) Saccus very short, broader slightly tapering anteriorly
   Dorsolateral lobe bears three spines
   Adeagus long, straight, hockey stick shaped at the base and
dumble shaped at anteriorly
   Genitalia more or less faint or light brown .................... A.mylitta
   arjuni

6) Adeagus straight and pointed anteriorly ....................... (7)
   Saccus notched
   Moth appearance grayish .............................................. A.mylitta grayei

7) Inner spine blunt
   Adeagus longer, tapering anteriorly, swollen
   Moth appearance not whitish........................................ A.mylitta badami
8) Saccus longer, more or less rounded anteriorly
   Harpes broad, long, pointed
   Adeagus longer than genitalia excluding distal spines …………………
   ……………………………………………………………… A.mylitta kolhapuriensis

9) Harpes very much broader, inner spine blunt
   Adeagus not straight ………………………………………….. (10)
   And equal to entire genitalia including distal spines …… A.mylitta sathei

10) Harpes longer and pointed
    Saccus notched
    Adeagus not banded not straight ………………………….. A.mylitta koynei

11) Saccus very narrow
    Dorsolateral spines very long
    Harpes broad, pointed and long
    Adeagus dark ……………………………………………… A.mylitta sahyadricus
ANTHERAEA MYLITTA INDICA  SUB SP. NOV

MALE (Fig. 29)
33 mm long, 8 mm broad, yellowish brown dorsally, brown ventrally; antenna light brown, bipectinate, except five apical segments, 17.4 mm long, 7.1 mm broad, 37 segmented; fore leg 21.7 mm long, wing expanse 125 mm.

HEAD
3 mm long, 5 mm broad, brown dorsally, ventrally grey; eyes rounded, large, light brown in colour, ocular distance 15 mm; proboscis vestigial; antenna 17.4 mm long, 7.1 mm broad, 37 segmented, terminally bifurcated, yellowish brown, scape 1 mm long, pedicel 0.40 mm long, flagellum 16 mm long; labial palpi upturned, three segmented, brownish.

Flagellar formula -- 1 L/W = 0.28, 15L/W= 1.75, T L/W= 2.4, A = 1.47

THORAX
10 mm long, 8 mm broad, dark brownish dorsally, greyish ventrally, pro, meso and metathorax brown with brown scales, scales 0.20 mm long.

Fore wing (Fig. 56a, 57a, 58a)
66 mm long, 33 mm broad, area of the fore wing 1251 mm², costal region of wing ash grey in colour; postmedian line pink with a white line on its border; antemedian line dark brown and bordered on the inside with a white line; oblique line brown with a indistinct faint white inner border; ventrally, pink, grey scales; antemedial line indistinct; medial line indistinct. Post medial line indistinct, margin in both wings brown. Ocellus (Fig. 57a) 68 mm² with a hyaline area 6 mm², median cross vein straight and not touching with A1 nor A2, anterior outer line black, anterior inner line white, anterior half dove grey, posterior outer line black, posterior inner line light yellow, posterior half dove grey. Hyaline area oval; wing scales generally conical and bristle like with up to nine spines of different lengths. Anterio lateral edge
blunt not pointed, fore wing outer curvature (Fig. 58a) not ‘s’ shaped, wing expanse – 125mm.

**Hind wing**

43mm long , 35 mm broad , area of hind wing 1171mm² ; area of ocellus 62 mm², area of hyaline spot 4 mm² ; hyaline area oval shaped ; antemedian line dark brown but narrow ; oblique line absent, post median line prominent and broad.

**Fore leg**

21.7 mm long , 1.6 mm broad , brown coloured ; coxa 2.8 mm long ; trochanter 1.0 mm long ; femur 5.80 mm long ; tibia 7.0 mm long, hind tibial spurs present; tarsus 4.5 mm long, five segmented ; claw 0.60 mm long, curved , dark brown. scales 0.18mm long and 0.13mm width.

**ABDOMEN**

20 mm long, 7 mm broad, dorsally brownish, densely covered with brownish scales on dorsal, ventral and lateral sides, scales 0.18mm long and 0.13mm width.

**Genitalia** (Fig. 30)

1) 10.10 mm long, 6.10 mm broad, Uncus bifid, sparsely set with setae on the dorsal side, apex notched, down curved, hook like median dorsal process, chitinised, ending into two pointed teeth on each side.

2) Vinculum very short, saccus short slightly pointed, not rounded anteriorly and bulbus.

3) Harpes hinged to the lateral sides of vinculum, trilobed, first lobes muscular and flexible bearing numerous setae as well as strong bristles; dorsolateral lobe chitinous and bears three spines of distal extremity. Harpes spines comparatively larger.

4) Tegumen broader in the middle, narrow at the both ends, apically the end produced into a flattened process, latter broadened at its end.
5) Anellus very strong, chitinised in to a quadrate plate above with extends down words and inwards a conical prolongation.
6) Adeagus (Fig.31) 9.60 long, 0.85 mm broad, narrow, basal part shorter than apical part, latter denticulate in its distal on third part, ventrally produced into a bow shaped plate.

**COCOON**

White grey in colour at surface, oval shaped, filament texture golden yellow.

1) Cocoon weight (g) : 8.42
2) Shell weight (g) : 1.12
3) Shell ratio (%) : 13.30
4) Cocoon length (cm) : 4.4
5) Cocoon width (cm) : 2.4
6) Peduncle length (cm) : 2.3
7) Peduncle width (mm) : 0.08
8) Peduncle weight (mg) : 0.10
9) Ring diameter (mm) : 7
10) Filament length (mt) : 292.20
11) Reeled weight (g) : 0.27
12) Denier : 8.31

**HOST PLANTS**

Ber (Z. jujuba), Arjun (T. arjuna),
Ain (T. tomentosa), Badam (T. catappa).

**HOLOTYPE**

Male, India, Maharashtra, Coll. 18-VI-2008, Ajara (Ramthirth)
Kavane. R.P., leg, antenna, wing on card sheet, body pinned in insect box, labeled as above.

**PARATYPE**

12 males: 3 females, sex ratio (m: f) 4:1, coll, from May to December, same data as above.
ETYMOLOGY
The sub sp. name *indica* refers to the found in India.

DISTRIBUTIONAL RECORD

REMARKS
Review of literature indicates that the present form runs close to *Antheraea mylitta* ecorace Sukinda by having following characters,
1) Cocoon weight 2) Shell weight 3) Silk ratio 4) Denier
However, it differs from above ecorace by having following characters.
1) Cocoon weight – 8.42 g 2) Shell weight – 1.12 g
3) Silk ratio – 13.30 4) Denier- 8.31
5) Morphological characters –
a) Hook like fore wing curvature
b) Medial line straight and strong
c) Hyaline area oval
d) Ocellus colour and radius
e) Genitalia size and shape

This sub species runs close to *jujubi* by having with 3 spines on dorsolateral lobe. However, it differs by having following characters
1) Adeagus long, knife like, longer and broder than *indica*
2) Saccus anteriorly rounded and wider and slightly notched to base
3) Fore wing curvature
4) Hyaline area
5) Flagellar formula - 1 L/W = 0.28, 15L/W= 1.75, T L/W= 2.4, A = 1.47
ANTHERAEA MYLITTA  JUJUBI SUB SP.NOV

MALE (Fig.32)
38 mm long, 12 mm broad, yellowish brown dorsally, brown ventrally; antenna light brown, bipectinate, except five apical segments, 17.4 mm long, 7.1 mm broad, 37 segmented; fore leg 21.7 mm long, wing expanse 138 mm.

HEAD
3 mm long, 5 mm broad, brown dorsally, ventrally grey; eyes rounded, large, light brown in colour, ocular distance 15 mm; proboscis vestigial; antenna 17.4 mm long, 7.1 mm broad, 37 segmented, terminally bifurcated, yellowish brown, scape 1 mm long, pedicel 0.40 mm long, flagellum 16 mm long; labial palpi upturned, three segmented, brownish.

Flagellar formula -- 1 L/W = 0.43, 15L/W = 1.39, T L/W = 1.76, A = 1.19

THORAX
12 mm long, 10 mm broad, dark brownish dorsally, greyish ventrally, pro, meso and metathorax brown with brown scales, scales 0.20 mm long.

Fore wing (Fig. 56b, 57b, 58b)
73 mm long, 49 mm broad, area of the fore wing 1295 mm², costal region of wing ash grey in colour; postmedian line pink with a white line on its border; antemedian line dark brown and bordered on the inside with a white line; oblique line brown with an indistinct faint white inner border; ventrally, pink, grey scales; antemedial line indistinct; medial line indistinct. Post medial line indistinct, margin in both wings brown. Ocellus (Fig. 58b) 62 mm² with a hyaline area 16 mm², median cross vein straight, anterior outer line reddish pink, anterior inner line white, anterior half dove grey, posterior outer line black, posterior inner line light yellow, posterior half dove grey. Hyaline area circular; wing scales generally conical and bristle like with up to nine spines of different lengths. Anterio lateral edge blunt not pointed, fore wing outer curvature (Fig. 57b) not ‘S’ shaped, wing expanse – 138 mm.
Hind wing

49mm long, 45 mm broad, area of hind wing 922 mm²; area of ocellus 52 mm², area of hyaline spot 6 mm²; hyaline area oval shaped; antemedian line dark brown but narrow; oblique line absent, Post median line prominent and broad.

Fore leg

21.7 mm long, 1.6 mm broad, brown coloured; coxa 2.8 mm long; trochanter 1.0 mm long; femur 5.80 mm long; tibia 7.0 mm long, hind tibial spurs present; tarsus 4.5 mm long, five segmented; claw 0.60 mm long, curved, dark brown.

ABDOMEN

23 mm long, 12 mm broad, dorsally brownish, densely covered with brownish scales on dorsal, ventral and lateral sides, scales 0.20 mm long, 0.10 mm width.

Genitalia (Fig. 33)

1) 11.20mm long, 6.10 mm broad, Uncus bifid, sparsely set with setae on the dorsal side, apex notched, down curved, hook like median dorsal process, chitinised, ending into two pointed teeth on each side.
2) Vinculum very short, saccus short slightly pointed, not rounded anteriorly and bulbus.
3) Harpes hinged to the lateral sides of vinculum, trilobed, first two lobes muscular and flexible bearing numerous hairs; median lobe more membranous, broad and densely set with setae; dorsolateral lobe chitinous and bears one short and two long spines at distal extremity, harpes spines comparatively larger.
4) Tegumen broader in the middle, narrow at the both ends, apically the end produced into a flattened process, latter broadened at its end.
5) Anellus very strong, chitinised, circular; anal opening chitinised into an almost quadrate plate.
6) Adeagus (Fig. 34) 9.40 mm long, 0.85 mm broad, narrow, basal part shorter than apical part, denticulate in its distal on third part, ventrally produced into a bow shaped plate.

**COCOON**

Yellow in colour at surface, oval shaped, filament texture golden yellow.

1) Cocoon weight (g) : 9.42  
2) Shell weight (g) : 0.95  
3) Shell ratio (%) : 10.08  
4) Cocoon length (cm) : 4.7  
5) Cocoon width (cm) : 2.8  
6) Peduncle length (cm) : 3.4  
7) Peduncle width (mm) : 0.12  
8) Peduncle weight (mg) : 0.12  
9) Ring diameter (mm) : 9  
10) Filament length (mt) : 282.30  
11) Reeled weight (g) : 0.26  
12) Denier : 8.28

**HOST PLANTS**

Ber (Z. jujuba), Arjun (T. arjuna), Asan (T. tomentosa), Badam (T. Catappa)

**HOLOTYPE**

Male, India, Maharashtra, Coll. 8-VI-2008, Panhala, M.S, Kavane R. P., antenna, leg, wing on card sheet, body pinned in insect box, labeled as above.

**PARATYPE**

12 males : 4 females, sex ratio (m:f) 3:1, coll, from May to December, same data as above.
ETYMOLOGY
The sub sp. name *jujupi* refers to the collection on food plant ber.

DISTRIBUTIONAL RECORD

REMARKS
Review of literature indicates that the present form runs close to *Antheraea mylitta* ecorace Giribum by having following characters,
1) Cocoon weight 2) Shell weight 3) Silk ratio 4) Denier
However, it differs from above ecorace by having following characters.
1) Cocoon weight – 9.42 gm. 2) Shell weight – 0.95 gm.
3) Silk ratio – 10.08 4) Denier- 8.28
5) Morphological characters –
   a) Hook like fore wing curvature
   b) Medial line straight and strong
   c) Hyaline area circular
   d) Ocellus colour and radius
   e) Genitalia shape and size
      i) Saccus on the top slightly pointed and not rounded anteriorly as in sub sp. *kolhapurensis*.
      ii) Harpes spines comparatively larger than the sub sp. *kolhapurensis*.
      iii) Distal spines relatively shorter than the sub sp. *kolhapurensis*.
      iv) Adeagus shape and size.
   f) Anterior lateral edge blunt not pointed, fore wing curvature not ‘S’ shaped.
   g) Abdominal length, width proportion with sub sp. *kolhapurensis*. 
This species runs close to *A.m. indica* by having three spines on dorsolateral lobe. However it differs from indica by having following characters

1) Genitalia more or less faint or brown
2) Adeagus long knife shaped longer & broader than *indica*
3) Saccus not notched basally
4) Harpes considerably longer and pointed
5) Fore wing curvature
6) Hyaline area
7) Flagellar formula – 1 L/W = 0.43, 15L/W= 1.39, T L/W= 1.76, A = 1.19
ANTHERAEA MYLITTA ARJUNI SUB SP.NOV

MALE (Fig. 35)

35mm long, 11 mm broad, yellowish brown dorsally, brown ventrally; antenna light brown, bipectinate, except a five apical segments, 17.4 mm long, 7.1 mm broad, 37 segmented; fore leg 21.7mm long, wing expanse 132mm.

HEAD

3mm long, 5 mm broad, brown dorsally, ventrally grey; eyes rounded, large, light brown in colour, ocular distance 15 mm; proboscis vestigial; antenna 17.4 mm long, 7.1 mm broad, 37 segmented, terminally bifurcated, light brown, scape 1 mm long, pedicel 0.40 mm long, flagellum 16 mm long; labial palpi upturned, three segmented, brownish.

Flagellar formula -- 1 L/W = 0.42, 15L/W= 1.32, T L/W= 2.87, A = 1.53

THORAX

11mm long, 8 mm broad, dark brownish dorsally, greyish ventrally, pro, meso and metathorax brown with brown scales, scales 0.15 mm long.

Fore wing (Fig. 56c, 57c, 58c)

73mm long, 47 mm broad, area of the fore wing 1465 mm², costal region of wing ash grey in colour; postmedian line pink with a white line on its border; antemedian line dark brown and bordered on the inside with a white line; oblique line brown with a indistinct faint white inner border; ventrally, pink, grey scales; antemedial line indistinct; medial line indistinct. Post medial line indistinct, margin in both wings brown. Ocellus (Fig. 58c) 66mm² with a hyaline area 10mm², median cross vein wavy and not touching with A1 nor A2, anterior outer line reddish pink, anterior inner line white, anterior half pink, posterior outer line black, posterior inner line light yellow, posterior half dove grey. Hyaline area circular; wing scales generally conical and bristle like with up to nine spines of different length. Anterio lateral edge blunt not pointed, fore wing outer curvature(Fig. 57c) not ‘S’ shaped, wing expanse – 132 mm.
Hind wing

46mm long, 40 mm broad, area of hind wing 932 mm²; area of ocellus 52 mm², area of hyaline spot 6 mm²; hyaline area oval shaped; antemedian line is dark brown; oblique line absent.

Fore leg

21.7 mm long, 1.6 mm broad, brown coloured; coxa 2.8 mm long; trochanter 1.0 mm long; femur 5.80 mm long; tibia 7.0 mm long, tibial spurs present; tarsus 4.5 mm long, five segmented; claw 0.60 mm long, curved, dark brown.

ABDOMEN

21mm long, 11 mm broad, dorsally brownish, densely covered with brownish scales on dorsal, ventral and lateral sides, scales 0.15 mm long, 0.12mm broad.

Genitalia (Fig.36)

1) 11.15 mm long, 6.10mm broad, Uncus bifid, sparsely set with setae on the dorsal side, apex notched, down curved, hook like median dorsal process, chitinised, ending into two teeth on each side.
2) Vinculum very short, entering into a short and bulbous saccus.
3) Harpes hinged to the lateral sides of vinculum, trilobed, first lobes are muscular and flexible bearing numerous hairs; dorsolateral lobe chitinous and bears three spines of distal extremity.
4) Tegumen broader in the middle, narrow at both ends, apically the end produced into a flattened process, latter broadened at its end.
5) Anellus very strong, chitinised, circular, anal opening chitinised into an almost quadrate plate.
6) Adeagus (Fig. 37) 10.15mm long, 0.85mm broad, narrow, basal part shorter than apical part, latter denticulate in its distal on third part, ventrally produced into a bow shaped plate.
COCOON
Bright yellow in colour at surface, oval shaped, filament texture golden yellow.

1) Cocoon weight (g) : 10.42
2) Shell weight (g) : 1.20
3) Shell ratio (%) : 11.51
4) Cocoon length (cm) : 5.1
5) Cocoon width (cm) : 2.8
6) Peduncle length (cm) : 2.6
7) Peduncle width (mm) : 20
8) Peduncle weight (mg) : 0.12
9) Ring diameter (mm) : 6
10) Filament length (mt) : 342.20
11) Reeled weight (g) : 0.42
12) Denier : 11.04

HOST PLANT
Ber (Z. jujuba), Arjun (T. arjuna), Ain (T. tomentosa).

HOLOTYPE
Male, India, Maharashtra, Coll. 18-VI-2008, Hatkanangle, Kavane. R.P., leg, antenna, wing on card sheet, body pinned in insect box, labeled as above.

PARATYPE
10 males : 4 females, sex ratio (m:f) 1:0.4, coll, from May to December, same data as above.

ETYMOLOGY
The sub sp. name arjuni refers to the collection on food plant arjuna.
DISTRIBUTIONAL RECORD

REMARKS
Review of literature indicates that the present form runs close to *Antheraea mylitta* ecorace Barharwa by having following characters,
1) Cocoon weight  2) Shell weight  3) Silk ratio  4) Denier
However, it differs from above ecorace by having following characters.
1) Cocoon weight – 10.42 gm.  2) Shell weight – 1.20 gm.
3) Silk ratio – 11.51  4) Denier- 11.04
5) Morphological characters –
a) Hook like fore wing curvature
b) Medial cross vein wavy and strong.
c) Hyaline area circular
d) Ocellus colour and radius
e) Genitalia shape and size
This species runs close to *A.mylitta* sub sp. *jujubi* by having three spines on dorsolateral lobe. However, it differs from above species having following characters.
1) Adeagus long, straight, hockey stick shaped at base and dumble shaped anteriorly
2) Genitalia more or less faint or brown
3) Harpes very thick and long
4) Fore wing curvature
5) Hyaline area
6) Flagellar formula – 1 L/W = 0.42, 15L/W= 1.32, T L/W= 2.87, A = 1.53
ANTHERAEA MYLITTA GRAYEI SUB SP.NOV

MALE (Fig. 38)
34mm long, 9 mm broad, yellowish brown dorsally, brown ventrally; antenna light brown, bipectinate, except five apical segments, 17.4 mm long, 7.1 mm broad, 37 segmented; fore leg 21.7 mm long, wing expanse 126 mm.

HEAD
3 mm long, 5 mm broad, brown dorsally, ventrally grey; eyes rounded, large, light brown in colour, ocular distance 15 mm; proboscis vestigial; antenna 17.4 mm long, 7.1 mm broad, 37 segmented, terminally bifurcated, light brown, scape 1 mm long, pedicel 0.40 mm long, flagellum 16 mm long; labial palpi upturned, three segmented, brownish.

Flagellar formula -- 1 L/W = 0.33, 15L/W = 1.5, T L/W = 1.66, A = 1.16

THORAX
11 mm long, 8 mm broad, dark brownish dorsally, greyish ventrally, pro, meso and metathorax brown with brown scales, scales 0.18 mm long.

Fore wing (Fig. 56d, 57d, 58d)
62 mm long, 39 mm broad, area of the fore wing 1265 mm², costal region of wing ash grey in colour; postmedian line pink with a white line on its border; antemedian line dark brown and bordered on the inside with a white line; oblique line brown with an indistinct faint white inner border; ventrally, pink, grey scales; antemedial line indistinct; medial line indistinct. Post medial line indistinct, margin in both wings brown. Ocellus (Fig. 58d) 65 mm² with a hyaline area 13 mm², median cross vein wavy and not touching with A1 nor A2, anterior outer line reddish pink, anterior inner line white, anterior half dove grey, posterior outer line black, posterior inner line light yellow, posterior half dove grey. Hyaline area circular; wing scales generally conical and bristle like with up to nine spines of different lengths. Anterio lateral edge blunt not pointed, fore wing outer curvature (Fig. 57d) not ‘S’ shaped, wing expanse – 126 mm.
Hind wing

37mm long, 31 mm broad, area of hind wing 815 mm²; area of ocellus 62 mm², area of hyaline spot 6 mm²; hyaline area oval shaped; antemedian line dark brown but narrow; oblique line absent, post median line prominent and broad.

Fore leg

21.7 mm long, 1.6 mm broad, brown coloured; coxa 2.8 mm long; trochanter 1.0 mm long; femur 5.80 mm long; tibia 7.0 mm long, tibial spurs present; tarsus 4.5 mm long, five segmented; claw 0.60 mm long, curved, dark brown.

ABDOMEN

20mm long, 9 mm broad, dorsally brownish, densely covered with brownish scales on dorsal, ventral and lateral sides, scales 0.18mm long, 0.15mm broad.

Genitalia (Fig. 39)

1) 11.80 mm long, 6.10 mm broad, Uncus bifid, sparsely set with setae on the dorsal side, apex notched, down curved, hook like median dorsal process, chitinised, ending into two teeth on each side.
2) Vinculum very short, entering into a short, slightly pointed, not rounded anteriorly and bulbous saccus.
3) Harpes hinged to the lateral sides of vinculum, trilobed, first lobes muscular and flexible bearing numerous hairs; dorsolateral lobe chitinous and bears three spines of distal extremity, harpes spine comparatively larger.
4) Tegumen broader in the middle, narrow at the both ends, apically the end produced into a flattened process, latter broadened at its end.
5) Anellus very strong, chitinised, circular; anal opening chitinised into an almost quadrate plate.
6) Adeagus (Fig. 40) 9.10mm long, 0.85mm broad, narrow, basal part shorter than apical part, denticulate in its distal on third part, ventrally produced into a bow shaped plate.

**COCOON**

White grey in colour at surface, oval shaped, filament texture golden yellow.

1) Cocoon weight (g) : 12.04  
2) Shell weight (g) : 1.65  
3) Shell ratio (%) : 13.70  
4) Cocoon length (cm) : 4.6  
5) Cocoon width (cm) : 2.8  
6) Peduncle length (cm) : 2.4  
7) Peduncle width (mm) : 14  
8) Peduncle weight (mg) : 0.12  
9) Ring diameter (mm) : 6  
10) Filament length (mt) : 253.20  
11) Reeled weight (g) : 0.45  
12) Denier : 12.44

**HOST PLANT**

Ber (Z. jujuba), Arjun (T. arjuna), Ain (T. tomentosa).

**HOLOTYPE**

Male, India, Maharashtra, Coll. 8-VI-2008, Shindewadi, Kavane. R.P., leg, antenna, wing on card sheet, body pinned in insect box, labeled as above.

**PARATYPE**

8 males: 6 females, sex ratio (m: f) 1:1.33, coll, from May to December, same data as above.

**ETYMOLOGY**

The sub sp. name grayi refers to the colour of moth.
DISTRIBUTIONAL RECORD

REMARKS
Review of literature indicates that the present form runs close to Antheraea mylitta ecorace Munga by having following characters,
1) Cocoon weight 2) Shell weight 3) Silk ratio 4) Denier
However, it differs from above ecorace by having following characters.
1) Cocoon weight – 12.04 gm. 2) Shell weight – 1.65 gm.
3) Silk ratio – 13.70 4) Denier- 12.44
5) Morphological characters –
   a) Hook like fore wing curvature
   b) Medial cross vein wavy and strong
   c) Hyaline area circular
   d) Ocellus colour and radius
   e) Genitalia shape and size
This species runs close to A.mylitta indica by having three spines of dorsolateral lobe and ocellus. However, it differ from indica by having following characters.
1) Saccus notched
2) Moth appearance grayish
3) Adeagus straight
4) Entire genitalia dark except saccus
5) Fore wing curvature
6) Hyaline area
7) Antemedian line somewhat zigzag in fashion
8) Flagellar formula -- 1 L/W = 0.33, 15L/W= 1.5, T L/W= 1.66, A = 1.16
ANTHERAEA MYLITTA KOLHAPURENSIS SUB.SP.NOV

MALE (Fig.41)
33 mm long, 9 mm broad, yellowish brown dorsally, brown ventrally; antenna light brown, bipectinate, except a five apical segments, 17.4 mm long, 7.1 mm broad, 37 segmented; fore leg 21.7 mm long, wing expanse 144mm.

HEAD
3mm long , 5 mm broad , brown dorsally, ventrally grey ; eyes rounded , large , light brown in colour, ocular distance 15 mm ; proboscis vestigial ; antenna 17.4 mm long , 7.1 mm broad, 37 segmented, terminally bifurcated , yellowish brown , scape 1 mm long , pedicel 0.40 mm long, flagellum 16 mm long ; labial palpi upturned, three segmented, brownish.

Flagellar formula -- 1 L/W = 0.33, 15L/W= 1.52, T L/W= 1.75, A = 1.20

THORAX
11mm long, 8 mm broad, dark brownish dorsally, greyish ventrally; pro, meso and metathorax brown with brown scales; scales 0.20 mm long.

Fore wing (Fig. 56e, 57e, 58e)
69 mm long, 50 mm broad, area of the fore wing 1380 mm², costal region of wing ash grey in colour; postmedian line pink with a white line on its border; antemedian line dark brown and bordered on the inside with a white line; oblique line brown with a indistinct faint white inner border; ventrally, pink, grey scales; antemedial line indistinct; medial line indistinct. Post medial line indistinct, margin in both wings brown. Ocellus (Fig. 58e) 73mm² with a hyaline area 27 mm², median cross vein concave and not touching with A1 nor A2, anterior outer line reddish pink, anterior inner line white, anterior half dove grey , posterior outer line black. Posterior inner line light yellow, posterior half dove grey. Hyaline area oval; wing scales generally conical and bristle like with up to nine spines of different lengths. Anterior lateral edge blunt not pointed, fore wing outer curvature (Fig. 57e) not ‘S’ shaped. Wing expanse – 144 mm
Hind wing

40mm long, 45 mm broad, area of hind wing 945 mm²; area of ocellus 57 mm², area of hyaline spot 6 mm²; hyaline area oval shaped; antemedian line is dark brown; oblique line absent.

Fore leg

21.7 mm long, 1.6 mm broad, brown coloured; coxa 2.8 mm long; trochanter 1.0 mm long; femur 5.80 mm long; tibia 7.0 mm long, Hind tibial spurs present; tarsus 4.5 mm long, five segmented; claw 0.60 mm long, curved, dark brown.

ABDOMEN

19 mm long, 9 mm broad, dorsally brownish, densely covered with brownish scales on dorsal, ventral and lateral sides. Scales 0.20 mm long and 0.15 mm broad.

Genitalia (Fig. 42)

1) 11.20 mm long, 5.10 mm broad, Uncus bifid, sparsely set with setae on the dorsal side, apex notched, down curved, hook like median dorsal process, chitinised, ending into two pointed teeth on each side.

2) Vinculum very short, saccus long and rounded at its end.

3) Harpes hinged to the lateral sides of vinculum, trilobed, first lobes are muscular and flexible bearing numerous hairs; dorsolateral lobe chitinous and bears two spines of distal extremity.

4) Tegumen broader in the middle, narrow at both ends, apically the end produced into a flattened process, latter broadened at its end.

5) Anellus very strong, chitinised, circular, anal opening chitinised into an almost quadrate plate.

6) Adeagus (Fig. 43) 9.80 mm long, 0.85 mm broad, narrow, basal part shorter than apical part, latter denticulate in its distal on third part, ejaculatory duct enters at the side near the base, the distal end slightly bent and serrated.
COCOON

Bright yellow in colour at surface, oval shaped, filament texture golden yellow.

1) Cocoon weight (g) : 9.35
2) Shell weight (g) : 1.40
3) Shell ratio (%) : 14.97
4) Cocoon length (cm) : 3.6
5) Cocoon width (cm) : 2.3
6) Peduncle length (cm) : 3.6
7) Peduncle width (mm) : 23
8) Peduncle weight (mg) : 0.10
9) Ring diameter (mm) : 4
10) Filament length (mt) : 265.40
11) Reeled weight (g) : 0.26
12) Denier : 8.81

HOST PLANTS
Ber (Z. jujuba), Arjun (T. arjuna),
Desi badam (T. cattapa), Asan (T. tomentosa).

HOLOTYPE
Male, India, Maharashtra, Coll. 8-VI-2007, Hatkanangle (Ramling),
Kavane. R.P., leg, antenna, wing on card sheet, body pinned in insect box,
labeled as above.

PARATYPE
12 males : 24 females, sex ratio (m: f) 2:1, coll, from May to December, same
data as above.

ETYMOLOGY
The sub sp. name kolhapurensis refers to the found in Kolhapur.
**DISTRIBUTIONAL RECORD**


**REMARKS**

Review of literature indicates that the present form runs close to *Antheraea mylitta* ecorace Sarihan by having following characters,

1) Cocoon weight  
2) Shell weight  
3) Silk ratio  
4) Denier

However, it differs from above ecorace by having following characters.

1) Cocoon weight – 9.35 gm.  
2) Shell weight – 1.40 gm.  
4) Denier- 8.81

5) Morphological characters –
   a) Hook like fore wing curvature  
   b) Medial line convex and strong  
   c) Hyaline area - Oval shaped  
   d) Ocellus colour and radius  
   e) Genitalia shape and size

This sub species runs close to *A.mylitta koynei* by having two spines on dorsolateral lobe and having blackish brown colour to genitalia. However, it differs from above species by following characters.

1) Proportion of width of genitalia and length of harper, in *A.mylitta kolhapurensis* is breadth is more than the *koynei* and length of harper is smaller than koynayi. In *A. mylitta kolhapurensis* saccus is more or less parallel sided and in *A.mylitta koynei* it is completely notched.

2) Shape of adeagus and its colour

3) Fore wing curvature
4) Hyaline area
5) Antemedian line
6) Saccus longer more or less rounded anteriorly
7) Harpes broad long. Pointed
8) Adeagus longer than genitalia excluding distal spines
9) Flagellar formula – 1 L/W = 0.33, 15L/W= 1.52, T L/W= 1.75, A = 1.20
**ANTHERAEA MYLITTA KOYNEI** **SUB SP.NOV**

**MALE** (Fig.44)

34 mm long, 11 mm broad, yellowish brown dorsally, brown ventrally; antenna light brown, bipectinate, except a five apical segments, 17.4 mm long, 7.1 mm broad, 37 segmented; fore leg 21.7 mm long, wing expanse 125 mm.

**HEAD**

3 mm long, 5 mm broad, brown dorsally, ventrally grey; eyes rounded, large, light brown in colour, ocular distance 15 mm; proboscis vestigial; antenna 17.4 mm long, 7.1 mm broad, 37 segmented, terminally bifurcated, yellowish brown, scape 1 mm long, pedicel 0.40 mm long, flagellum 16 mm long; labial palpi upturned, three segmented, brownish.

**Flagellar formula** -- $1 \text{L/W} = 0.40$, $15 \text{L/W} = 1.33$, $T \text{L/W} = 1.81$, $A = 1.18$

**THORAX**

11 mm long, 11 mm broad, dark brownish dorsally, greyish ventrally, pro, meso and metathorax brown with brown scales, scales 20 mm long.

**Fore wing** (Fig. 56f, 57f, 58f)

60 mm long, 37 mm broad, area of the fore wing 1365 mm$^2$, costal region of wing ash grey in colour; postmedian line pink with a white line on its border; antemedian line dark brown and bordered on the inside with a white line; oblique line brown with a indistinct faint white inner border; ventrally, pink, grey scales; antemedial line indistinct; medial line indistinct. Post medial line indistinct, margin in both wings brown. Ocellus (Fig. 58f) 82 mm$^2$ with a hyaline area 25 mm$^2$, median cross vein straight and not touching with A1 nor A2, anterior outer line reddish pink, anterior inner line white, anterior half dove grey, posterior outer line black, posterior inner line light yellow, posterior half dove grey. Hyaline area circular; wing scales generally conical and bristle like with up to nine spines of different lengths. Anterio lateral edge blunt not pointed, fore wing outer curvature (Fig. 57f) not ‘S’ shaped, wing expanse – 125 mm.
**Hind wing**

36 mm long, 25 mm broad, area of hind wing 922 mm²; area of ocellus 52 mm², area of hyaline spot 4 mm²; hyaline area oval shaped; antemedian line is dark brown; oblique line absent.

**Fore leg**

21.7 mm long, 1.6 mm broad, brown coloured; coxa 2.8 mm long; trochanter 1.0 mm long; femur 5.80 mm long; tibia 7.0 mm long, tibial spurs present; tarsus 4.5 mm long, five segmented; claw 0.60 mm long, curved, dark brown.

**ABDOMEN**

20 mm long, 10 mm broad, dorsally brownish, densely covered with brownish scales on dorsal, ventral and lateral sides, Scales 0.20 mm long and 0.18 mm broad.

**Genitalia** (Fig. 45)

1) 11.90 mm long, 5.40 mm broad, Uncus bifid, sparsely set with setae on the dorsal side, apex notched, down curved, hook like median dorsal process, chitinised, ending into two pointed teeth on each side.

2) Vinculum very short, entering into a short and bulbus saccus.

3) Harpes hinged to the lateral sides of vinculum, trilobed, first two lobes are muscular and flexible bearing numerous hairs; dorsolateral lobe chitinised and bears two spines of distal extremity.

4) Tegumen broader in the middle, narrow at the both ends, apically the end produced into a flattened process, latter broadened at its end.

5) Anellus very strong, chitinised, circular, anal opening chitinised into an almost quadrate plate.

6) Adeagus (Fig. 46) 9.85 mm long, 0.85 mm broad, narrow, basal part shorter than apical part, latter denticulate in its distal on third part, ventrally produced into a bow shaped plate.
COCOON

Yellow in colour at surface, oval shaped, filament texture golden yellow.

1) Cocoon weight (g) : 8.75
2) Shell weight (g) : 0.90
3) Shell ratio (%) : 10.28
4) Cocoon length (cm) : 4.3
5) Cocoon width (cm) : 2.6
6) Peduncle length (cm) : 3.2
7) Peduncle width (mm) : 20
8) Peduncle weight (mg) : 0.10
9) Ring diameter (mm) : 9
10) Filament length (mt) : 245.00
11) Reeled weight (g) : 0.20
12) Denier : 7.34

HOST PLANT
Ber (Z. jujuba), Arjun (T. arjuna).

HOLOTYPE
Male, India, Maharashtra, Coll. 18-VI-2008, Patan. Kavane. R.P., leg, antenna, wing on card sheet, body pinned in insect box, labeled as above.

PARATYPE
08 males: 04 females, sex ratio (m:f) 2:1, coll, from May to December, same data as above.

ETYMOLOGY
The sub sp. name koynei refers to the found in Koyna region Patan.
**DISTRIBUTION RECORD**


**REMARKS**

Review of literature indicates that the present form runs close to *Antheraea mylitta* ecorace Nowgaon by having following characters,

1) Cocoon weight  
2) Shell weight  
3) Silk ratio  
4) Denier

However, it differs from above ecorace by having following characters.

1) Cocoon weight – 8.75 gm.  
2) Shell weight – 0.90 gm.  
3) Silk ratio – 10.28  
4) Denier- 7.34

5) Morphological characters –
   a) Hook like fore wing curvature
   b) Medial cross vein straight and strong
   c) Hyaline area circular
   d) Ocellus colour and radius
   e) Genetilia shape and size

This sub species runs close to *A.mylitta koynei* runs close to *A.mylitta Kolhapurensis* by having two spines on dorsolateral lobe and having blackish brown colouration of genitalia. However, it differs from *A.mylitta Kolhapurensis* by following characters.

1) Harpes longer and pointed
2) Saccus notched
3) Adeagus not banded, not straight, colour is faint yellow and not dark brown
4) Fore wing curvature
5) Antemedial line
6) Proportion of genitalia width and harper length
7) Flagellar formula -- 1 L/W = 0.40, 15L/W= 1.33, T L/W= 1.81, A = 1.18
ANTHERAEA MYLITTA SATHEI SUB SP.NOV

MALE(Fig.47)
35mm long, 11 mm broad, yellowish brown dorsally, brown ventrally; antenna yellowish brown ,bipectinate, except a five apical segments, 17.4 mm long , 7.1 mm broad , 37 segmented; fore leg 21.7mm long , wing expanse 125mm

HEAD
3mm long , 5 mm broad , brown dorsally, ventrally grey ; eyes rounded , large , light brown in colour, ocular distance 15 mm ; proboscis vestigial ; antenna 17.4 mm long, 7.1 mm broad , 37 segmented , terminally bifurcated , light brown , scape 1 mm long , pedicel 0.40 mm long, flagellum 16 mm long ; labial palpi upturned, three segmented, brownish.
Flagellar formula -- 1 L/W = 0.36, 15L/W= 1.32, T L/W= 2.87, A = 1.53

THORAX
11mm long, 8 mm broad, dark brownish dorsally, greyish ventrally, pro, meso and metathorax brown with brown scales, scales 20 mm long.

Fore wing (Fig. 56g, 57g, 58g)
62mm long, 42 mm broad, area of the fore wing is about 1268 mm², costal region of wing ash grey in colour; postmedian line pink with a white line on its border; antemedian line dark brown and bordered on the inside with a white line; oblique line brown with a indistinct faint white inner border; ventrally, pink, grey scales; antemedial line indistinct; medial line indistinct. Post medial line indistinct, margin in both wings brown. Ocellus(Fig. 58g) 72 mm² with a hyaline area 24 mm² , median cross vein straight and not touching with A1 norA2, anterior outer line reddish pink, anterior inner line white, anterior half dove grey , posterior outer line black, posterior inner line light yellow, posterior half dove grey. Hyaline area circular; wing scales generally conical and bristle like with up to nine spines of different lengths. Anterior lateral edge blunt not pointed, fore wing outer curvature (Fig. 57g) not ‘S’ shaped. Hook like curvature of fore wing, wing expanse -125 mm.
Hind wing

38mm long, 34 mm broad, area of hind wing 785 mm²; area of ocellus 68 mm², area of hyaline spot 6 mm²; hyaline area oval shaped; antemedian line is dark brown; oblique line absent.

Fore leg

21.7 mm long, 1.6 mm broad, brown coloured; coxa 2.8 mm long; trochanter 1.0 mm long; femur 5.80 mm long; tibia 7.0 mm long, tibial spurs present; tarsus 4.5 mm long, five segmented; claw 0.60 mm long, curved, dark brown.

ABDOMEN

21mm long, 11 mm broad, dorsally brownish, densely covered with brownish scales on dorsal, ventral and lateral sides. Scales 0.20 mm long and 0.18 mm broad.

Genitalia (Fig.48)

1) 11.20 mm long, 6.10 mm broad, Uncus bifid, sparsely set with setae on the dorsal side, apex notched, down curved, hook like median dorsal process, chitinised, ending into two teeth on each side.
2) Vinculum very short, entering into a short and bulbous saccus.
3) Harpes hinged to the lateral sides of vinculum, trilobed, first lobes are muscular and flexible bearing numerous hairs; dorsolateral lobe chitinised and bears two spines of distal extremity.
4) Tegumen broader in the middle, narrow at the both ends, apically the end produced into a flattened process, latter broadened at its end.
5) Anellus very strong, chitinised, circular, anal opening chitinised into an almost Quadratum plate.
6) Adeagus (Fig.49) 10.10 mm long, 0.85 mm broad, narrow, basal part shorter than apical part, latter denticulate in its distal on third part, ventrally produced into a bow shaped plate.
**COCOON**

Bright yellow in colour at surface, oval shaped, filament texture golden yellow.

1) Cocoon weight (g) : 11.42  
2) Shell weight (g) : 1.65  
3) Shell ratio (%) : 14.44  
4) Cocoon length (cm) : 4.2  
5) Cocoon width (cm) : 2.7  
6) Peduncle length (cm) : 2.4  
7) Peduncle width (mm) : 20  
8) Peduncle weight (mg) : 0.11  
9) Ring diameter (mm) : 5  
10) Filament length (mt) : 285.30  
11) Reeled weight (g) : 0.44  
12) Denier : 13.88

**HOST PLANT**

Ber (*Z. jujuba*), Arjun (*T. arjuna*), Ain (*T. tomentosa*).

**HOLOTYPE**

Male, India, Maharashtra, Coll. 8-VI-2008, Hatkanangle. Kavane. R.P., leg, antenna, wing on card sheet, body pinned in insect box, labeled as above.

**PARATYPE**

10 males: 4 females, sex ratio (m:f) 1:0.4, coll, from May to December. Same data as above.

**ETYMOLOGY**

The sub sp. name *sathei* refers to the honour of guide.
DISTRIBUTION RECORD
Western Maharashtra, Hatkanangle 03-VII-2008; 1♀,2♂, Panhala 12-IV-2008; 1♀,1♂, Radhangari 28-VII-2007; 1♀,1♂, Patan 12-IV-2007; 0♀,1♂, Anuskara 18-IV-2008; 1♀,1♂, Dehu- Alandi 28-IV-2007; 0♀,1♂, Kokroud 12-IV-2008; 0♀,1♂, Malakapur 12-IV-2007; 0♀,2♂.

REMARKS
Review of literature indicates that the present form runs close to Antheraea mylitta ecorace Sukinda by having following characters,
1) Cocoon weight 2) Shell weight 3) Silk ratio 4) Denier
However, it differs from above ecorace by having following characters.
1) Cocoon weight – 11.42 gm. 2) Shell weight – 1.65 gm.
3) Silk ratio – 14.44 4) Denier- 13.89
5) Morphological characters –
a) Hook like fore wing curvature
b) Medial cross vein straight and strong
c) Hyaline area circular
d) Ocellus colour and radius
e) Genitalia shape and size
This sub species runs close to A.mylitta sathei runs close to A.mylitta Kolhapurensis by having two spines on dorsolateral lobe and anterio lateral fore wing acute or some what pointed, hyaline area not circular. However, it differs from kolhapurensis by following characters .
1) Harpes very much broder
2) Inner spine blunt
3) Adeagus not straight
4) Entire genitalia light, yellow in colour except the inner third lobes.
5) Saccus narrowing anteriorly
6) Fore wing curvature
7) Antemedial line
8) Hyaline area
9) Flagellar formula-- 1 L/W = 0.36, 15L/W= 1.32, T L/W= 2.87, A = 1.53
**ANTHERAEA MYLITTA BADAMI SUB SP.NOV**

**MALE** (Fig.50)
31 mm long, 8mm broad, yellowish brown dorsally, brown ventrally; antenna yellowish brown ,bipectinate, except a five apical segments, 17.4 mm long , 7.1 mm broad , 37 segmented; fore leg 21.7 mm long , wing expanse 126mm .

**HEAD**
3mm long , 5 mm broad , brown dorsally, ventrally grey ; eyes rounded , large , light brown in colour, ocular distance 15 mm ; proboscis vestigial ; antenna 17.4 mm long, 7.1 mm broad , 37 segmented , terminally bifurcated , yellowish brown , scape 1 mm long , pedicel 0.40 mm long, flagellum 16 mm long ; labial palpi upturned, three segmented, brownish.

**Flagellar formula** -- 1 L/W = 0.33, 15L/W= 1.50, T L/W= 1.25, A = 1.02

**THORAX**
10mm long, 8 mm broad, dark brownish dorsally, greyish ventrally , pro, meso and metathorax brown with brown scales, scales 20 mm long.

**Fore wing** (Fig. 56h, 57h, 58h)
62 mm long, 37 mm broad, area of the fore wing 1223 mm², costal region of wing ash grey in colour; postmedian line pink with a white line on its border; antemedian line dark brown and bordered on the inside with a white line; oblique line brown with a indistinct faint white inner border; ventrally, pink, grey scales; antemedial line indistinct; medial line indistinct. Post medial line indistinct, margin in both wings brown. Ocellus(Fig. 58h) 67mm² with a hyaline area 7 mm² , median cross vein concave and not touching with A1 nor A2, anterior outer line reddish pink, anterior inner line white, anterior half dove grey , posterior outer line black. Posterior inner line light yellow, posterior half dove grey, hyaline area oval; wing scales generally conical and bristle like with up to nine spines of different lengths. Anterio lateral edge
blunt not pointed, fore wing outer curvature (Fig. 57h) not ‘S’ shaped. Wing expanse – 126mm.

**Hind wing**

39 mm long, 32 mm broad, area of hind wing 782 mm²; area of ocellus 64 mm², area of hyaline spot 4 mm²; hyaline area oval shaped; antemedian line is dark brown; oblique line absent.

**Fore leg**

21.7 mm long, 1.6 mm broad, brown coloured; coxa 2.8 mm long; trochanter 1.0 mm long; femur 5.80 mm long; tibia 7.0 mm long, hind tibial spurs present; tarsus 4.5 mm long, five segmented; claw 0.60 mm long, curved, dark brown.

**ABDOMEN**

18 mm long, 7 mm broad, dorsally brownish, densely covered with brownish scales on dorsal, ventral and lateral sides. Scales 0.18 mm long and 0.16 mm broad.

**Genitalia** (Fig. 51)

1) 9.80 mm long, 5.80 mm broad, Uncus bifid, sparsely be set with setae on the dorsal side, apex notched, down curved, hook like median dorsal process, chitinised, ending into teeth on each side.

2) Vinculum very short, saccus short and bulbus.

3) Harpes hinged to the lateral sides of vinculum, trilobed, first lobes are muscular and flexible bearing numerous setae as well as strong bristles; dorsolateral lobe chitinous and bears two spines of distal extremity.

4) Tegumen broader in the middle, narrow at both ends, apically the end produced into a flattened process, latter broadened at its end.

5) Anellus very strong, chitinised, circular, anal opening chitinised into an almost quadrate plate.
6) Adeagus (Fig.52) 10.20 mm long, 0.85mm broad, narrow, basal part shorter than apical part, latter denticulate in its distal one third part, ventrally produced into a bow shaped plate.

**COCOON**

Light grey in colour at surface, oval shaped, filament texture golden yellow.

1) Cocoon weight (g) : 7.80
2) Shell weight (g) : 0.60
3) Shell ratio (%) : 7.69
4) Cocoon length (cm) : 3.6
5) Cocoon width (cm) : 2.4
6) Peduncle length (cm) : 2.4
7) Peduncle width (mm) : 20
8) Peduncle weight (mg) : 0.12
9) Ring diameter (mm) : 11
10) Filament length (mt) : 310.15
11) Reeled weight (g) : 0.32
12) Denier : 9.28

**HOST PLANTS**

Ber (Z. jujuba), Arjun (T. arjuna).

**HOLOTYPE**


**PARATYPE**

12 males: 2 females, sex ratio (m:f) 6:1, coll, from May to December, same data as above.

**ETYMOLOGY**

The sub sp. name *badami* refers to their food plant badam.
DISTRIBUTIONAL RECORD


REMARKS

Review of literature indicates that the present form runs close to *Antheraea mylitta* ecorace Sarihan by having following characters,

1) Cocoon weight  
2) Shell weight  
3) Silk ratio  
4) Denier

However, it differs from above ecorace by having following characters.

1) Cocoon weight – 7.80 gm.  
2) Shell weight – 0.60 gm.  
3) Silk ratio – 7.69  
4) Denier- 9.28

5) Morphological characters –
   a) Hook like fore wing curvature
   b) Medial line concave and strong
   c) Hyaline area oval shape
   d) Ocellus colour and radius
   e) Genitalia shape and size

This sub species runs close to *A.mylitta sahydricus* by having two spines on dorsolateral lobe, fore wing acute or some what pointed, hyaline area not circular. However, it differs from *A.m. sahydricus* by following characters.

1) Saccus broder and shorter than sahydricus
2) Inner third lobe not straight, bent turn outwards
3) Adeagus faint and straight
4) Forewing curvature
5) Hyaline area
6) Adult body colour reddish yellow
7) Inner spine blunt
8) Adeagus long tapering anteriorly, swollen mid anteriorly, moth appearance not white.
9) Flagellar formula -- 1 L/W = 0.33, 15L/W= 1.50, T L/W= 1.25, A = 1.02
ANTHERAEA MYLITTA SAHYADRICUS SUB SP.NOV

MALE (Fig.53)

33 mm long, 9 mm broad, reddish brown dorsally, brown ventrally; antenna light brown ,bipectinate, except a five apical segments, 17.4 mm long , 7.1 mm broad , 37 segmented; fore leg 21.7mm long , wing expanse 136mm .

HEAD

3mm long , 5 mm broad , brown dorsally, ventrally grey ; eyes rounded , large , light brown in colour, ocular distance 15 mm ; proboscis vestigial ; antenna 17.4 mm long, 7.1 mm broad , 37 segmented , terminally bifurcated , yellowish brown , scape 1 mm long , pedicel 0.40 mm long, flagellum 16 mm long ; labial palpi upturned, three segmented, brownish. Flagellar formula -- 1 L/W = 0.33, 15L/W= 1.50, T L/W= 1.25, A = 1.02

THORAX

11mm long, 8 mm broad, dark brownish dorsally, greyish ventrally, prothrox, meso and metathorax brown with brown scales, scales 20 mm long.

Fore wing (Fig. 56i, 57i, 58i)

70 mm long, 43 mm broad, area of the fore wing 1382 mm², costal region of wing ash grey in colour; postmedian line pink with a white line on its border; antemedian line dark brown and bordered on the inside with a white line; oblique line brown with a indistinct faint white inner border; ventrally, pink, grey scales; antemedial line indistinct; medial line indistinct. Post medial line indistinct, margin in both wings brown. Ocellus(Fig. 58i) 68 mm² with a hyaline area 35 mm² , median cross vein concave and not touching with A1 nor A2, anterior outer line pink, anterior inner line white, anterior half dove grey , posterior outer line black. Posterior inner line light yellow, posterior half dove grey. Hyaline area circular; wing scales generally conical and bristle like with up to nine spines of different lengths. Antero lateral edge blunt not pointed, fore wing outer curvature (Fig. 57i) not ‘S’ shaped.

Wing expanse – 136mm.
Hind wing

40mm long, 36 mm broad, area of hind wing 882 mm²; area of ocellus 62 mm², area of hyaline spot 6 mm²; hyaline area circular shaped; antemedian line is dark brown; oblique line absent.

Fore leg

21.3 mm long, 1.6 mm broad, brown coloured; coxa 2.8 mm long; trochanter 1.0 mm long; femur 5.80 mm long; tibia 7.0 mm long, hind tibial spurs present; tarsus 4.5 mm long, five segmented; claw 0.60 mm long, curved, dark brown.

ABDOMEN

19 mm long, 9 mm broad, dorsally brownish, densely covered with brownish scales on dorsal, ventral and lateral sides, scales 0.18 mm long and 0.15 mm broad.

Genitalia (Fig.54)

1) 9.30mm long, 5.10 mm broad, Uncus bifid, sparsely be set with setae on the dorsal side, apex notched, down curved, hook like median dorsal process, chitinised, ending into two pointed teeth on each side.
2) Vinculum very short, saccus long and rounded at its end.
3) Harpes hinged to the lateral sides of vinculum, trilobed, first two lobes are muscular and flexible bearing numerous hairs; dorsolateral lobe chitinous and bears two spines at distal extremity.
4) Tegumen broader in the middle, narrow at the both ends, apically the end produced into a flattened process, latter broadened at its end.
5) Anellus very strong, chitinised, circular, anal opening chitinised into an almost quadrate plate.
6) Adeagus (Fig.55) 9.70 mm long, 0.85mm broad, narrow, basal part shorter than apical part, latter denticulate in its distal on third part, ventrally produced into a bow shaped plate.
COCOON

Bright yellow in colour at surface, oval shaped, filament texture golden yellow.

1) Cocoon weight (g) : 7.65
2) Shell weight (g) : 0.90
3) Shell ratio (%) : 11.76
4) Cocoon length (cm) : 3.6
5) Cocoon width (cm) : 2.1
6) Peduncle length (cm) : 3.2
7) Peduncle width (mm) : 15
8) Peduncle weight (mg) : 0.09
9) Ring diameter (mm) : 8
10) Filament length (mt) : 311.20
11) Reeled weight (g) : 0.31
12) Denier : 8.96

HOST PLANT

Ber (Z.jujuba), Arjun (T. arjuna),
Asan (T. tomentosa).

HOLOTYPE

Male, India, Maharashtra, Coll. 18-VII-2008, Hatkanangle (ramling), Kavane. R.P., leg, antenna, wing on card sheet, body pinned in insect box, labeled as above.

PARATYPE

12males: 06 females, sex ratio (m:f) 2:1, coll, from May to December, same data as above.

ETYMOLOGY

The sub sp. name sahydricus refers to the found in Sahyadri Ghat.
DISTRIBUTIONAL RECORD


REMARKS

Review of literature indicates that the present form runs close to *Antheraea mylitta* ecorace Nowgaon by having following characters,
1) Cocoon weight          2) Shell weight          3) Silk ratio            4) Denier

However, it differs from above ecorace by having following characters.
1) Cocoon weight – 7.65 gm.              2) Shell weight – 0.90 gm.
3) Silk ratio – 11.76                               4) Denier- 8.96

5) Morphological characters –
   a) Hook like fore wing curvature 
   b) Medial line convex and strong 
   c) Hyaline area circular 
   d) Ocellus colour and radius 
   e) Genitalia shape and size 

The sub species *A.mylitta sahyadricus* runs close to *A.mylitta badami* by having two spines on dorsolateral lobe and general appearance of genitalia. However, it differs from above sub species by following characters.
1) Saccus very narrow
2) Dorsolateral spine very long
3) Harper broad, pointed, long
4) Adeagus dark and blackish
5) Forewing curvature
6) Hyaline area
7) Flagellar formula – 1 L/W = 0.33, 15L/W= 1.50, T L/W= 1.25, A = 1.02