

Indian Arthropods in Early Sanskrit Literature: A Taxonomical Analysis

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Abstract

Mahaṛṣi Manu, the author of *Manuśmṛiti* (500-400 BCE) classified living beings into four major types — *Jarāyuja*, *Aṇḍaja*, *Svedaja* and *Udbhija*. Insects were kept in *Svedaja* category. Ṛṣi Manu occupies the same place of honour in Indian literature as Aristotle in Greek philosophy. Insects have been known to man, since Vedic times. There are references of the terms like *ṣaṭpada* (six legged) in the *Mahābhārata*. *Suśruta Saṃhitā* had six varieties of ants, six varieties of flies, five varieties of mosquitoes, eight varieties of Centipedes, thirty varieties of scorpions and sixteen varieties of spiders. There are various species of bees referred to in *Caraka Saṃhitā*. The *Tattvārthādhigama Sūtra* (1st BCE) by Umāsvatī gives various details of classifications based on number of senses of animals and insects. Even there are morphological variations and behavior of insects in various works of Kālidāsa like *Raghuvamśam* and *Abhijyān Śakuntalam* and others. An attempt has been made here to assess the taxonomic concepts of insects as mentioned in ancient Indian literature.

Key words: Ancient Sanskrit literature, Arthropods, Taxonomy

1. INTRODUCTION

The Phylum Arthropoda is the largest and most successful of animal phyla. It comprises class Insecta or Hexapoda, which includes Insects, class Arachnida; involves Scorpions, Spiders, class Chilopoda contains Centipedes. The foundation of Entomology in India was laid during the period represented by Indus Valley civilization. Ancient Indian philosophical commentaries and literature clearly mention about arthropods. In Sanskrit literature, there are numerous references of Insects, Arachnids and Chilopods. Sanskrit word *ṣaṭpāda* (means six legged) is used as synonym of Hexapoda and '*krin* (i.e. hundred legged) is described for centipede. To cite a few, are *Madulika* (Honeybee), *Maśaka* (Mosquito), *Makṣika* (Flies), *Jabhya* (Butterflies), *Patāṅga* (Moths), *Khadyota* (Glowworms), *Upjivika* or

Valmi (Termites), *Tarda* (Insect borer), *Śalbha* (Locusts), *Pipilika* (Ants), *Bhramara* (Bees), *Damśa* (Gnats), *Lakṣa* (Lac Insect), *Vṛścika* (Scorpion), *Luta* (Spiders), *Ṣaṭpāda* (Centipede) etc. It is also worthwhile to mention that our ancestors (Vedic seers) have made taxonomic assessment of arthropods and their relatives by using morphology, ecology and behavior and assigned nomenclature to them accordingly. The role of harmful insects in the destruction of crops and importance of useful insects in the production of honey, silk and lac have been greatly realized in ancient literature.

It has also been observed that great attention has been paid to control insects of agricultural, medical and veterinary importance by using various control measures and also by adopting Integrated Pest Management, such as

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reciting *mantras* (prayers), various cultivation techniques, mechanical practices, fumigation with herbal products. Now, modern agricultural and medical scientists also shifting towards non chemical methods to control insect pests. Undoubtedly, these are eco friendly, cheaper and long lasting.

Hence, it is quite evident that our ancient seers have given due importance to study insects in relation to their taxonomy, ecology and behaviour. During present investigations various ancient Indian texts i.e. Vedas, *Caraka Saṃhitā*, *Manuśmṛti*, *Suśruta Saṃhitā*, as well as works of Kālidāsa, Prasastapāda, Umāśvati, Latyāyana, and Dalhana have been surveyed for the study of insects and *Amakośa* (Sanskrit) of Amar Singh (1982) and A Sanskrit-English Dictionary of Williams (1986) have been referred for nomenclature of insects.

2. CLASSIFICATION OF THE LIVING BEINGS

2.1 *Manuśmṛti* (Bhatt, 2001) classified living beings into four major types:

(i) *Jarāyujā*: Born from uterus – Man, Placental mammals, (ii) *Aṇḍajā*: Born from an egg – Fishes, Amphibians Reptiles, Birds (iii) *Svedajā*: Born from moisture and heat – Insects like Gad flies, Mosquitoes, Louse, House fly, Bed bug etc (iv) *Udbhijā*: Born from seeds by breaking soil and also through stem – Plants

‘पशवश्चमृगाश्चैवव्यालाश्चोभयतोदतः ।
रक्षांसि च पिशाचाश्चमनुयाश्चजरायुजाः’ ॥
‘अण्डजाः पक्षिणः सर्पानक्रामत्स्याश्चकच्छपाः ।
यानिचैवंप्रकाराणिस्थलजान्यौदकानि च’ ॥
‘स्वेदजदंशमशकं यूकामक्षिकमत्कुणम् ।
ऊमणश्चोपजायन्ते यच्चान्यत्किंचिदीदं शम्’ ॥
‘उद्भिज्जाः स्थावराः सर्वेबीजकाण्डप्ररोहिणः ।
ओषध्यः फलपाकान्तावहुपुष्पफलोपगाः’ ॥

(*Manuśmṛti* 1.43-46)

The animals, deer or wild animals, elephants, the ones, who have teeth on both sides, wicked and mischievous ones and humans are born from uterus

are called *Jarāyujā*. Birds, snakes, crocodiles, fishes, tortoises and all other creatures like these, who born in water as well as on earth are called *Aṇḍajā* (born from eggs). At the same time insects like Gad flies, mosquitoes, louse, house fly, beg-bug and all other like these, born from heat are called *Svedajā*. And those born through seeds by breaking soil or by planting stem, which become trees are called *Udbhijā*. After giving fruit, those, who dry up and which are full of flowers and fruit are known as *Auśdhi*.

2.2 Prastapāda (400-300 BCE) divided animal kingdom into two major types (Kapoor, 1988)

a. *Ayonija*: (Asexual) which are minute in size, more than hundred in handful, without bones, without their own blood and not easily crushed

b. *Yonija*: (Sexual) further divided into two types – *Jarāyujā*: Born out of uterus with placenta-Placental mammals and *Aṇḍajā*: Oviparous-Insects, Fishes, Reptiles, Birds.

2.3 *Umāśvatī* divided animals on the basis of number of senses (Jaini, 1920)

a. Animals with two senses: i.e. touch and taste: *Apidaka* (Verms without lateral appendages); *Nupuraka* (Annulated with pendants, worms with unsegmented lateral appendages, Annelids); *Gandupada* (Knotty-legged: Arthropoda, including Crustacea, Myriopoda); *Sankha* (Some forms of Mollusca: Conical gastropods); *Sambuka* (Helix); *Suktika* (Pearl- Mussel. Lamellibranchates); *Jaluka* (Leeches).

b. Animals with three senses: i.e. touch, taste and smell

Pipilika (Ants) (Hymenoptera: Formicidae); *Rohinika* (Red ants) (Hymenoptera: Formicidae); *Upachika*, *Kunthu*, *Tuburaka* (Bugs and fleas) (Hemiptera: hemimetabola); *Trapusavija* and *Karpasasthika* (Cucumber and cotton weevils, lice); *Sathapadi* and *Uthpalaka* (Spring tails) (Machilidae); *Trinapatra* (Aphids); *Kastha-haraka* (Termites, white ants and ant-lions)

c. Animals with four senses: i.e. sight, smell, taste, and touch

Bhramra (Bees); *Varatha* (Wasps); *Saranga* (Hornets); *Makṣika* (Flies); *Puttika* (Flies); *Dansa* (Gad flies); *Maśśakas* (Mosquitoes); *Vṛscika* (Scorpions); *Nandyāvartha* (Spiders); *Kiṭa* (Butterflies and Moths); *Pataṅga* (Grasshoppers and Locusts)

d. Animals with five well developed senses i.e. sight, smell, taste, touch and hearing
Matsya (Fishes); *Uraga* (Amphibians) (Legless ones); *Bhujaṅga* (Crawl and run on the chest) (Snakes); *Pakṣī*: (With wings) (Birds); *Catuspāda* (Four limbed) (Quadrupeds and man)

3. TAXONOMIC ASSESSMENT OF ARTHROPODS IN ANCIENT INDIAN LITERATURE

3.1 Vedas (Wilson, 1978; Whitney, 1971; Satvalekar, 1958; Trivedi, 2004): In Vedas, various arthropods like - Ants, Honey bees, Grasshopper, Locust, Moth, Mosquito, Termite, House flies, Insect grain borer, Scorpions, Spiders are mentioned. Some of these are:

3.1.1 Mosquitoes

‘ये शालाः परिनृत्यन्तिसायंगर्दभनादिनः ।
कुसूला ये कुक्षिलाः ककुभाः करूमाः सिमाः ।
तानोषधेत्वंगन्धेनविषूचीनान् विनाशय’ ॥

(Atharvaveda 8.6.10)

The mosquitoes, who dance around the dwellings in the evening, (which we call as swarming for mating in scientific language) making donkey-noises, having needle like mouth parts, big abdomens and who spread diseases. O herb! with your smell, you do make to disappear and scatter these demons.

In this above cited *mantra*, characteristics, behavior and habits of the mosquito are described as needle like mouth parts (कुसूला), big abdomen (कुक्षिलाः), which is unequal (ककुभाः). Similarly, if we observe the behavior of a mosquito, nobody likes the noise of a donkey, the same way the noise of mosquito is also very harsh to the ears. It is also mentioned in the *mantra* that the mosquitoes are more active at dusk (परिनृत्यन्तिसायम्).

3.1.2 Insect pests of crops

‘तदहैषतंगहैजभ्य हाउपक्वस ।
ब्रह्मेवासंस्थितंहविरनदन्तइमान् यवानहिंसन्नतोअपोदित’ ॥

(Atharvaveda 6.50.2)

Hey borer hey Locust ! hey seed destroyer! As god leaves impure oblation in the same way, you may leave these without eating and destroying, you may go away.

In this *mantra*, the economic importance of three insect pests (including stored grain pest) in the destruction of crops is mentioned.

3.1.3 Termites

यदत्त्युपजिह्विका यद्वभ्री अतिसर्पति । सर्वं तदस्तु ते घृतम्’ ॥

(Rgveda 8.102.21)

The termite getting attracted to smell, enters deep into the eatable wood covers it with earth and attacks it internally

Kālidāsa has also mentioned in *Abhigyan Sākuntalam* (VII-II) and *Meghadutam* (*Purvamegha* 15) that well built termite hill becomes habitat for other animals like lizards, Snakes and Scorpions. Even birds built nest inside it. Sen Sharma (1974) also reported occurrence of birds nest, lizards, Snakes and scorpions in the termite mounds.

3.1.4 Scorpions

य उभाभ्यां प्रहरसि पुच्छेन चास्येन च ।
आस्ये न ते विषं किमु ते पुच्छधवसत् ॥

(Atharvaveda 7.56.8)

A Scorpion attacks both with its tail and mouth but it has no poison in its mouth why it is present in its tail only

In this *mantra*, the stinging behavior and presence of stinging apparatus in the tail of scorpion has been beautifully described

3.2 Suśruta (400-300 BCE) (Sen-Sharma, 1974): Suśruta mentioned even different varieties within arthropods on the basis of their habits, habitat, behavior and various morphological

characteristics like colour, shape, size. These are: Six varieties of ants, Six varieties of flies, Five varieties of mosquitoes, Eight varieties of centipedes, Thirty varieties of scorpions and Sixteen varieties of spiders.

3.2.1 Six varieties of Ant (पिपीलिका)

पिपीलिकाः-स्थूलशीर्षा, संवाहिका, ब्राह्मणिका, अंगुलिका, कपिलिका, चित्रवर्णैति षट् ।

(*Suśruta Saṃhitā* 5.8.34)

Ants – *Sthūlaśīrṣā* (Huge Head) (Soldiers-modified workers with enormous head and mandibles); *Samvāhika* (Carry load) (Workers); *Brāhmṇika* (Do not work) (Queen); *Aṅgulikā* (Long) (Carpenter Ant); *Kapilikā* (Brown), (Fire ant); *Citrāvāṇā* (having many colors)

3.2.2 Six varieties of flies (मक्षिका)

‘मक्षिकाः-कान्तारिका, कृष्णा, पिंगला, मधूलिका, काषायी, स्थालिकेत्येवं षट् ।

(*Suśruta Saṃhitā* 5.8.35)

Flies – *Kāntārika* (Good looking) (*Calliphoridae*, Blow fly); *Kṛṣṇā* (Black) (*Simulidae Simulium* spp, Black fly); *Piṅgalā* (Yellow) (*Tabanidae*); *Madhulikā* (Produces honey) (*Apidae*, Honey bee); *Kāṣāyī* (Dull) (*Sarcophagidae*, Fleshfly); *Sthālikā* (Broad) (*Tabanidae* Horse fly)

3.2.3 Five varieties of mosquitoes (मशकः)

‘मशकाः-सामुद्रः, परिमण्डलो, हस्तिमशकःकृष्णः, पार्वतीयः इति पञ्च’

(*Suśruta Saṃhitā* 5.8.36)

Mosquitoes – *Sāmudra* (Sea-born or Coastal mosquitoes); *Parimaṇḍala* (Global or present worldwide); *Hastimaśaka* (Huge type or large in size); *Kṛṣṇa* (Black in colour); *Pārvatīya* (Available at mountainous regions)

3.2.4 Three types of Scorpions (वृश्चिका)

‘त्रिविधा वृश्चिकाः प्रोक्ता मन्दमध्यमहाविषाः’

(*Suśruta Saṃhitā* 5.8.56)

Scorpions into three types on the basis of extent of poison – *Manda* (of mild Poison), *Madhya* (of moderate poison) and *Mahāviṣā* (of powerful poison), which were further divided into thirty varieties on the basis of their appearance . These are -

a. Features of Scorpions of Mild Poison

‘कृष्णः श्यावः कर्बुरः पाण्डुवर्णो गोमूत्रभः कर्कशो मेचकश्च ।’
पीतो धूम्रोरोमशः शाड्वलाभो रक्तः श्वेतोदरेणेति मन्दः ।’

(*Suśruta Saṃhitā* 5.8.59)

Those, which have colours, such as black, blue, brown, white and colour like cow’s urine, coarse (dull), blue-black, yellow, smoky, which have hairs on their belly resembling algae, red, white are mild poisonous i.e. *mandaviṣa*.

b. Features of Scorpions of moderate poison

‘रक्तः पीतः कापिलेनोदरेणसर्वेधूम्राः पर्वभिश्च त्रिभिः स्युः ।’
‘एते मूत्रेच्चारपूत्यण्डजाता मध्या ज्ञेयास्त्रिकारोरगणाम् ।’

(*Suśruta Saṃhitā* 5.8.61-62)

Scorpions, which are red, yellow, brown in their belly, smoky colour in their body, with three joints in their tail, those born from urine, excreta and decomposed eggs of three kinds of snakes are to be understood as moderate poisonous *madhyaviṣa*.

c. Features of Scorpions of strong Poison

‘श्वेतश्चित्रः यामलोलोहिताभोरक्तः वेतोरक्तनीलोदरौ च’ ।
‘पीतोऽरक्तोनीलपीतोऽपरस्तुरक्तोनीलोनीलशुक्लस्तथा च’ ।
‘रक्तोबभ्रुः पूर्ववच्चैकपर्वा यश्चापर्वा पर्वणी द्वे च यस्य’ ।।
‘नानारूपावर्णतश्चापि घोराज्ञेयाश्चैतेव श्चिकाः प्राणचौराः’ ।

(*Suśruta Saṃhitā* 5.8.63-65)

Those, which are white, of variegated colours, brown or reddish in their body, their belly being red, white reddish blue, yellowish-red, bluish-yellow, reddish-red (pink), bluish-white, red or grey, which have two joints in their tail, have different shapes (size), and colours, which are terrifying, these kinds of scorpions are to be known as thieves of life or killers *Prāṅcaurā*.

Scorpions are also known to glow a vibrant blue-green colour, when exposed to certain wavelengths of ultraviolet light such as that produced by a black light, this is due to the presence of beta-carboline fluorescent chemicals

present in the cuticle. The coloration ranges from dark orange or brightly red-brown through dull brown with darker grey carinae (ridges) and granulation. (Shawn et. al. 1999)

3.2.5 Spiders– Suśruta mentioned sixteen types of spiders, out of which eight are difficult to cure and the same number is incurable

‘त्रिमण्डला तथा श्वेता कपिलापीतिका तथा ।
आलमूत्रविषा रक्ता कसना चाष्टमी स्मृता’ ॥
‘ताभिर्दष्टे शिरोदुःखं कण्डूदंशे च वेदना ।
भवन्ति च विशेषेणगदाः श्लैष्मिकवातिकाः’ ॥

(Suśruta Saṃhitā 5.8.95-96)

a. Difficult to cure

Trimandlā (having three circles); *Śveta* (White); *Kapilā* (Brown); *Pītika* (Yellow); *Ālamūtraviṣa* (having poison in their saliva and urine); *Rakta* (Red); *Kasanā* (Grey).

b. Incurable

‘सौवर्णिकाः लाजवर्णा जालिन्धेणीपदी तथा ।
कृष्णाऽग्निवर्णाका काण्डा मालागुणाऽष्टमी तथा’ ॥
‘ताभिर्दष्टे दंशकोथः प्रवृत्तिः क्षतजस्य च ।
ज्वरो दाहोऽतिसारश्च गदाः स्युश्च त्रिदोषजाः’ ॥

(Suśruta Saṃhitā 5.8.97-98)

Sauvarṇika (Golden Coloured); *Lājavarṇā* (Wheatish Coloured); *Jālinī* (Printed); *Yeṇīpadī* (having many colours); *Kṛṣṇa* (Black); *Agnivarṇā* (Fire like coloured); *Kākāṇḍā* (like a crow egg); *Mālāguṇā* (like a thread of Necklace)

Three types of pigment (ommochromes, bilins and guanine) have been identified in spiders, although other pigments have been detected, but these are not yet characterized. Melanins, carotenoids and pterins, very common in other animals, are apparently absent. In some species, the exocuticle of the legs and prosoma is modified by a tanning process, resulting in brown coloration. Bilins are present in *Micrommata virescens*, resulting in its green color. Guanine is responsible for the white markings of the European garden spider *Araneus diadematus*. It is in many

species accumulated in specialized cells called guanocytes. In genera such as *Tetragnatha*, *Leucauge*, *Argyrodes* or *Theridiosoma*, guanine creates their silvery appearance. (Oxford and Gillespie, 1998).

3.2.6 Centipedes- Suśruta divided centipedes (which are mentioned as *krin* means 100 Legs) into eight types on the basis of their colours and symptoms of bite. These are-

शतपद्यस्तु-पक्षा, कृष्णा, चित्र, कपिला, पीतिका, रक्ता, वेता,
अग्निप्रभा इत्यष्टौ’

(Suśruta Saṃhitā 5.8.30)

Parūṣā (Strong, dry, hard) *Lithobius forficatus* Stone centipede; *Kṛṣṇa* (Black) (*Ethmostigmus rubripesspinosus* Indian Black Centipede); *Citrā* (having many colours) *Scolopendra polymorpha* “multicolored centipede”; *Kapilā* (Brown) (*Lithobius Brown centipedes*); *Pītikā* (Yellow) (*Haplophilus subterraneus* Yellow centipede); *Rakta* (Red) (*Scolopocryptops sexspinosus* Red Centipede); *Śveta* (White) (*Scutigrella immaculate* Clear coloured centipede); *Agniṣabhā* (Fire like coloured or Shining like fire) (*Orphaneus brevilabiatus*, Fire centipede)

Even today centipedes are generally known from their colours. These are dark brown, rusty red, reddish-green, white, yellow and bright red. However, some species have multiple colors, such as the giant red-headed centipede, having a rusty red head, yellow legs and a black body. These colors allow the centipedes to blend in with their environments. Centipedes camouflage themselves in their habitats, hiding from prey and predators under mulch, leaves rocks, logs, and wood piles.

3.3 Kālidāsa (100 BCE-1 CE) (Chaturvedi, 1980)

Kālidāsa’s works are also rich in description of various insects. He mentioned more than 18 insects in his various poems and plays like –

Ali, Bhramara, Madhukara, Dvirepha (Bees) (*Raghuvanśama* 3.8;5.43;6.7;7.11); *Damśa* (Insects that annoy cattle) (*Raghuvanśama* 2.5); *Lakṣa* (Lac insect) (*Raghuvanśama* 16.15); *Khadyota* (Glowworms or fire flies) (*Meghadutama* 21); *Śalabha* (Swarms of Locusts) (*Abhijñana Sakuntalam* 1-30); *Valmi* (Termite) (*Abhijñana Sākuntalam VII-11, Meghadutam* 15)

3.4 Dalhana & Latyāyana's (100-200 CE) (Sheshadri): The first taxonomist of the world, has suggested very interesting and authentic criteria for insect classification :

‘कटुभिः बिन्दुलेखाभिः पक्षैः पादैः मुखैः नखैः शूकैः कण्टकलांगलैः
संस्लिष्टैः पक्षरोमभिः ।
खनैः प्रमाणैः संस्थानैर्लिङ्गश्चापि शरीराङ्गैः विषवीर्यैश्चकीटानां
रूपज्ञानविभाव्यते’ ।।

Dottings or markings, wings, pedal appendages, mouth with antennae, claws, sharp pointed hairs, stings in the tail, hair on the wings, humming noise, size, structure, sexual organs poison and its action on bodies, through all these characters, insects are identified.

5. CONCLUDING REMARKS

The ancient Indian texts deal with almost all aspects of taxonomy, which include identification, classification and nomenclature. It is surprising how the ancient seers have made deep observations on external characters, colour, habitat, habits, behavior of arthropods, perhaps without using any high resolution microscope to study taxonomic characters. Even the first ever classification of organisms on the basis of mode of egg laying, name to the organisms on the basis of insects characteristic or diagnostic features, the classification of insects, identification of insects, spiders, scorpions, centipedes on the basis of their colour, behaviour, habitat and habits with their names accordingly, show that our forefathers devoted considerable attention to taxonomic studies of arthropods. This could not have been possible without careful researches, extensive and

elaborate observations continued over hundreds of years.

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