

A REVIEW OF THE PARASITIC FLAT BARK BEETLES (COLEOPTERA: PASSANDRIDAE) OF THE INDIAN SUBCONTINENT

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ABSTRACT

The small family Passandridae (Cucujoidea) or parasitic flat bark beetles occurs predominantly in the tropics and subtropics with four genera restricted to the Old and another four genera to the New World and only one pantropical genus. The fauna of the Indian subcontinent consists of 13 species of three genera. Five of the six *Ancistria* species are endemic to the subcontinent. A checklist and an identification key are provided for the species reported from the subcontinent. While the taxonomy and phylogeny of the family are comparatively well-studied, little is known about the biology. Adult passandrids are predators and larvae parasitoids of larvae and pupae of other wood-inhabiting insects such as beetles and Hymenoptera.

Key words: Ancistria, Aulonosoma, Passandra, Cucujoidea, checklist, identification key, phylogeny, fossils, biology

The parasitic flat bark beetles constitute the small, predominantly circumtropical family Passandridae, a member of the superfamily Cucujoidea (Coleoptera). Currently, 112 extant and three fossil species are known (Burckhardt and Ślipiński, 2003, 2010; Bukejs et al., 2021). They are attributed to nine extant and one fossil genera (Burckhardt and Ślipiński, 2010; Jin et al., 2019). Adult passandrids are found under bark or in tunnels of wood-boring insects, and they are sometimes attracted by light (Jin et al., 2019). The larvae are, as far as known, ectoparasitoids of wood-inhabiting Coleoptera and Hymenoptera (Burckhardt and Ślipiński, 2010). The parasitic way of life of the larvae is probably responsible for the considerable intraspecific size variation encountered in adults (Fig. 1A, B), that lead in the past to a very confused taxonomy at species level. Ślipiński (1987, 1989) and Burckhardt and Ślipiński (1991, 1995a) discussed this variability and sorted out the sometimes complex synonymies. While the taxonomy within the family and the phylogenetic relationships of the family are reasonably well established, little is known about the distribution of many species and even less is known on their biology. The present review summarises available information with the emphasis on the fauna of the Indian Subcontinent.

A. Morphology

Adult passandrids have a cylindrical (Fig. 1A–C) or dorso-ventrally flattened body (Fig. 1D). Within extant Cucujoidea with a tarsal formula 5-5-5 in both sexes, adult passandrids can be easily recognised by the large mandibles with exposed articulations, the fused or approximate gular sutures, the usually closed mesocoxal cavities and strongly unequal tibial spurs, the heavily sclerotised body, the externally reduced labrum, and the stout antennae often with marginal keel along the



Fig. 1. Habitus of A: *Ancistria retusa*, dorsal view; B: *Ancistria retusa*, oblique lateral view, same magnification as A; C: *Aulonosoma tenebrioides*; D: *Passandra heros*

terminal antennomere (Burckhardt and Ślipiński, 2003). The morphology of the larvae is highly modified as a result of the their parasitic habit. The first instar larva is a triangulinus with protracted mouthparts and is heavily sclerotised, flattened and spiny. The later instars have prognatous mouth parts and short two-segmented antennae, are posteriorly swollen, and possess simple setae and strongly reduced legs which are not distinctly articulated (Burckhardt and Ślipiński, 2003, 2010).

B. Diversity and the fauna

A checklist of the world Passandridae lists nine genera and 108 species (Burckhardt and Ślipiński, 2003). Four additional extant species have been described since (Ivie & Ślipiński, 2005; Aoki, 2008; Burckardt & Zürcher, 2013; Bukejs, 2019). Four genera are restricted to the Old World: *Ancistria* Erichson (35 valid species), *Aulonosoma* Motschulsky (3 spp.), *Nicolebertia* Burckhardt and Ślipiński (3 spp.) and *Passandrina* Reitter (2 spp.); four genera occur only in the New World: *Catogenus* Westwood (19 spp.), *Passandrella* Grouvelle (2 spp.), *Scalidiopsis* Burckhardt and Ślipiński (1 sp.) and *Taphroscelidia* Crotch (14 spp.); and *Passandra* Dalman is distributed in the Old (32 spp.) and New World (1 sp.).

The family Passandridae is well represented on the Indian Subcontinent with three genera (Fig. 1) and 13 species (for synonyms see Burckhardt and Ślipiński, 2003) (Table 1). *Ancistria* and *Passandra* are worldwide the two most species-rich genera and comprise also most of the species of the Indian Subcontinent with six and five species, respectively. While *Passandra* species are fairly widely distributed, five of the six recorded *Ancistria* species are endemic to the subcontinent. Based on this high percentage of endemism, it can be speculated that intensive and targeted field work will yield additional, new species.

Key to the adults of Passandridae species

(Compiled from the keys of Burckhardt and Ślipiński, 2003)

- Head without frontal or vertexal impressions or grooves. Elytra with 10 impressed striae (Fig. 1C)......2

- 3. Head with distinct median groove (Fig. 1A, B). Basal metatarsomere longer than or subequal to tarsomere 2......4
- Head with at most shallow median groove (Fig. 1D). Basal metatarsomere at most 0.5 times as long as tarsomere 2.....9

- 7. Pronotum more than 1.9 times as long as wide *Ancistria nepalensis*
- Pronotum less than 1.8 times as long as wide
- 8. Mandibles punctured dorsally...... Ancistria assamensis
- 9. Each elytron only with two complete lines 10
- Each elytron with at least three lines complete
- 10. Sublateral lines of pronotum interrupted basally.....*Passandra elongatula*

Species	Indian Subcontinent	General distribution
Ancistria assamensis Burckhardt and Ślipiński, 1995	India (Assam)	
Ancistria bostrychoides Grouvelle, 1908	India (Sikkim)	
<i>Ancistria brancuccii</i> Burckhardt and Ślipiński, 1995	Nepal	
Ancistria indica Burckhardt and Ślipiński, 1995 Ancistria nepalensis	India (Kerala, Tamil Nadu) Nepal	
Burckhardt and Slipiński, 1995		
<i>Ancistria retusa</i> (Fabricius, 1801)	India (Assam, Tamil Nadu), Sri Lanka	Africa: Cameroon, D. R. Congo, Eswatini, South Africa, Zaire, Zimbabwe; Asia: Brunei, China (Hainan), Indonesia (Java, Sumatra, Sulawesi, Kepulauan Tukangbesi, Moluccas, Am Island, Irian Jaya), Malaysia (Sabah, Sarawak), Papua New Guinea, Philippines (Mindoro, Negros, Mindanao, Luzon, Calapan, Palawan), Singapore, Taiwan, Thailand, Laos, Vietnam; Australia: Queensland, Victoria, possibly Tasmania; South America: one doubtful record from Brazil
Aulonosoma insignis (Grouvelle, 1891)	India (Karnataka, Uttar Pradesh, West Bengal), Bhutan, Nepal	Asia: China (Sichuan), Indonesia (Java), Malaysia, Myanmar, Philippines, Thailand, Vietnam
Aulonosoma tenebrioides Motschulsky, 1858	India (Karnataka, Darjeeling, Nilgiri Hills, Bengal, Sikkim), Nepal, Sri Lanka	Asia: Indonesia (Sumatra, Sulawesi, Timor), Malaysia (Peninsula), Myanmar, New Guinea, Philippines, Solomon Islands, Taiwan, Thailand, Vietnam; Africa (probably adventive): Kenya, Tanzania, Comoros; Europe (probably adventive): Germany
<i>Passandra elongatula</i> Grouvelle, 1874	Bhutan	Asia: Indonesia (Java, Molukkas, Sumatra), Laos (Vientiane), Malaysia (Malacca, Perak), Philippines
Passandra heros (Fabricius, 1801)	India, Sri Lanka	Asia: Brunei, Cambodia, China, Indonesia (Aru Island, Halmahera, Irian Jaya, Java, Moluccas, Seram, Sulawesi, Sumatra), Malaysia (Malay Peninsula, Sabah), Laos, Myanmar, Papua New Guinea, Philippines (Mindanao, Mindoro, Palawan), Solomon Islands, Taiwan, Thailand, Vietnam; Australia: New South Wales, Northern Territories, Queensland
Passandra rufipennis (Fabricius, 1801)	India (Tamil Nadu)	Asia: Borneo, Indonesia, Laos, Myanmar, Vietnam
Passandra trigemina (Newman, 1839)	Bangladesh, India, Sri Lanka	Asia: Indonesia (Aru Island, Irian Jaya, Java, Lombok, Moluccas, Seram, Sulawesi, Sumatra), Laos, Malaysia (Malay Peninsula, Sabah), Myanmar, New Guinea, Philippines, Solomon Islands, Thailand, Vietnam
Passandra uniformis (Waterhouse, 1876)	India, Sri Lanka	Asia: Indonesia (Sulawesi)

Table 1. List of species recorded	from the Indian	Subcontinent with	th distribution in and
outside the subcontinent (from	Burckhardt and	Ślipiński, 2003; J	Bukejs et al., 2021)

- Sublateral lines of pronotum entire Passandra heros
- 11. Elytra with three complete lines (1, 5, 6), line 2 never visible but rarely small basal pit *Passandra trigemina*

- Pronotal disc uniformly micropunctured, without group of coarse punctures medially. Antenna slender and antennomeres markedly longer than wide. General form larger and more flattened.....*Passandra uniformis*

D. Phylogeny and the fossil record

Crowson (1955) removed the Passandridae as separate family from the Cucujidae of which it was previously a subfamily. He suggested that the two families are closely related, but recent molecular studies support a closer relationship of the Passandridae with Laemophloeidae and Phalacridae, together with the two small families Cyclaxyridae and Myraboliidae (McElrath et al., 2015). This group is often called the laemophloeid clade within Cucujoidea (McElrath, et al., 2015). Jin et al. (2019) erected the subfamily [†]Mesopassandrinae for [†]Mesopassandra keyao, a fossil taxon described from Upper Cretaceous Burmese amber. In their cladistic analysis of passandrid genera with Cucujidae, Laemophloeidae and Phloeostichidae as outgroups, the *†*Mesopassandrinae constituted the sistergroup of the remainder of passandrids (= Passandrinae). Kirejtshuk et al. (2019) discussed the morphological characters used by Jin et al. (2019) to attribute the fossil subfamily to the Passandridae and concluded that this assignment is problematic and needs further research.

The internal relationships of passandrid genera were analysed by Burckhardt and Ślipiński (2003) and Jin et al. (2019). The latter authors included also two fossil taxa. The resulting phylogenies differ from each other fundamentally except for a monophyletic clade constituted by the three American genera *Passandrella*, *Scalidiopsis* and *Taphroscelidia*, which is supported in both analyses. Molecular data will be a good way of

testing the two competing hypotheses.

Fossil passandrids are rare and only three species have been described to date. The oldest species is *†Mesopassandra keyao*, which has been described from Burmese amber from the Upper Cretaceous. According to Jin et al. (2019), this taxon constitutes the sister group of all extant genera together. Kirejtshuk et al. (2019), however, listed several characters that this fossil shares with the Laemophloeidae and suggested that additional studies are required to elucidate its relationships. Kirejtshuk et al. (2019) described *†Passandra (?) plenaria* from the Menat Basin in France dating from the Middle Paleocene. They attributed the species provisionally to Passandra because it differs from extant congeners in the exposed labrum and the absence of a preapical groove or impression on the hypopygidum. The youngest of the three fossil Passandridae is *†Passandra septentrionaria* described from Eocene Baltic amber (Bukejs et al., 2016). In the cladistic analysis of Jin et al. (2019), this species constitutes the sister taxon of the extant Passandra species. The two fossil Passandra species were found in Europe were today no passandrids exist apart from the adventive Aulonosoma tenebrioides. The climatic conditions in Europe today are unsuitable for this mostly tropical family.

E. Biology

Very little is known about the biology of passandrids. The larvae are ectoparasitoids of wood-inhabiting beetle larvae such as longhorn, bark and ambrosia beetles as well as weevils or of Hymenoptera (Burckhardt and Ślipiński 2003). The adults are probably predadtors (Deepthi and Remadevi, 2012). The latter authors observed Aulonosoma insignis parasitising larvae of the powder post beetle, Sinoxylon anale Lesne (Coleoptera, Bostrichidae), a polyphagous species whose adults and larvae are serious pests on many economically important timber species. They observed that the females of A. insignis oviposit on the surface of the late instar host larvae. The females ususally lay one or sometimes two eggs per host. After hatching, the parasitoid larvae puncture the host skin and feed on the internal host tissues which ultimately kills the host. Adults emerge from March to October, with a peak in June and July. The life cycle of the parasitoid is shorter than that of its hosts (Deepthi and Remadevi, 2012).

Zubarán and Di Iorio (2018) reviewed the passandrid fauna of Argentina and adjacent countries. They observed that adults of Passandridae emerged from 25 plant species infested with 62 species of Cerambycidae (Coleoptera) and concluded that passandrid larvae are not host specific.

Bento (2023) discovered that Passandridae emit sounds when he heard a female of *Passandra fasciata* (Gray in Griffith) stridulating. In the following he studied the involved structures using scanning electron microscopy and found a prosterno-coxal stridulatory apparatus present in seven of the nine recognised genera. While he had no material at hand of the rare monotypic *Scalidiopsis* Burckhardt and Ślipiński, he did not find the apparatus in *Aulonosoma*. He concluded that the apparatus constitutes a synapomorphy of all extant passandrid genera apart from *Aulonosoma* Motschulsky. He thereby supported the phylogenetic hypothesis of Burckhardt and Ślipiński (2003).

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CONFLICT OF INTEREST

No conflict of interest.

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