

Nest Site Characteristics of *Seladonia* Bees (Hymenoptera: Halictidae): Insights for their Habitat-Based Conservation

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Abstract

The diversity of the sub-family Halictinae Thomson (Hymenoptera: Halictidae) in Kerala is represented by the genus *Halictus* Latreille, *Lasioglossum* Curtis, and *Sphecodes* Latreille. The study found the genus *Seladonia* grouped under the same taxon in Wayanad district of Kerala. Knowledge of the habitat and soil characteristics of their nest site is requisite for habitat-based conservation of these ground-nesting fauna. So, a brief investigation was carried out to understand their ecosystems, with special emphasis on the characteristics of the soils they nest in. The texture and aggregate strength of soil at the nesting site were analysed by the International Pipette method and Wet analysis, respectively. The ecosystem of the bees was usually undisturbed lands with hard lateritic soils. Through soil characterisation, the bees were found to inhabit clay loam with a very high aggregate strength of 6.1 mm mean weight diameter. The nest structure was studied by observing the excavated nest cast. Their subterranean nest directly opens to the ground surface and comprises 0.4 cm wide tunnels that end in 0.6 cm wide cells.

Key words: *Seladonia*, Halictine bees, Ground nesting bees, Soil characteristics, Nest architecture

Halictidae Thomson, with approximately 4510 species [1], is the second-largest bee family after Apidae. Bees of this family are commonly known as halictid bees or sweat bees. The majority of halictid bee fauna are pollinators of wild and agricultural ecosystems, and a few others are kleptoparasites. They usually nest underground, and a few inhabit fallen logs. Sociality within this family ranges from solitary living to eusociality.

In India, there exist 27 genera [2] and 216 species [3] of sweat bees. The family Halictidae is divided into four sub-families: Rophitinae Schenck, 1866, Nomiinae Robertson, 1904, Nomioidinae Börner, 1919, and Halictinae Thomson, 1869 [4]. The diversity of the sub-family Halictinae in Kerala is represented by species belonging to the genus *Halictus*, *Lasioglossum* and *Sphecodes*. Exploration of the halictine bee (Halictidae: Halictinae) diversity in Wayanad district of Kerala unveiled the presence of the genus *Seladonia*, adding to the diversity of halictine bees in the state.

Seladonia, like most other halictid bees, nests underground and are pollinators. They are grouped under the tribe Halictini, which is the dominant tribe of Halictidae [5]. Bees belonging to the genus *Seladonia* can be distinguished from the rest of Halictidae by their metallic green, gold or blue lustrous body sclerites. In addition to their characteristic coloration, members of this genus typically exhibit well-defined punctation on the exoskeleton and distinct

morphological features in the head and thorax, which aid in species-level identification. These bees are generally solitary to primitively eusocial, with some species showing flexible social behavior depending on environmental conditions. They construct simple burrows in well-drained soils, often preferring sunny, sparsely vegetated habitats. Ecologically, *Seladonia* species play a crucial role in the pollination of a wide range of wild flora and cultivated crops, thereby contributing significantly to biodiversity maintenance and ecosystem stability [6]. Their foraging activity is influenced by floral availability, temperature, and seasonal dynamics, making them valuable indicators of environmental change and habitat quality.

The majority of *Seladonia* species are adapted to deserts and semi-deserts [2]. These bees are present in Wayanad, where the weather is cold and dry. The ecosystem inhabited was recorded. The flowers visited by them in their habitats were noted to determine the pollen sources available. This study primarily emphasised the characteristics of their habitat. A large number of the *Seladonia* bees were found inhabiting a stream bank in Wayanad, Vengapally (11.628431/76.013756). The soil sample from the nests was analysed for its texture and aggregate strength. The general nest architecture of halictid bees consists of a central tunnel from which branches and brood cells arise. Halictid bees usually line their cell clusters with wax synthesised from Dufour's gland located beneath their abdomen

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[7]. This creates a barrier between the nest interior and the surrounding soil environment. A block of soil containing a few nests was examined in the laboratory to study their nest characteristics.

MATERIALS AND METHODS

A survey was conducted in Wayanad district of Kerala during the summer month of February 2025. The district had dry weather during the survey period. The coordinates of the locations where populations of *Seladonia* were present were noted. The flowers visited by the bees in their natural habitat were also recorded. A high population of *Seladonia* bees was found near a stream bank with land slope under dense cover of *Mimosa pudica* (11.628431/76.013756). Soil with a few nests was collected as samples for studying the soil characteristics. Soil texture, which is the relative proportion of sand, silt and clay was analysed by the international pipette method was used to analyse the texture. The aggregate strength of the soil, which would indicate the stability offered by the soil to the nest from the beating action of rain, was analysed using Yoder's apparatus. A block of soil containing a few nest openings was excavated and examined in the laboratory. The nest entrances found were cast with a suspension of Plaster of Paris. It was allowed to solidify and was later dissected to unveil its nest architecture.

RESULTS AND DISCUSSION

Seladonia bees were usually found in undisturbed ecosystems like stream banks. The (Table 1) below shows the locations from which *Seladonia* populations were identified.

In these ecosystems, the bees were found visiting the flowers of *Mimosa pudica* (Family: Fabaceae), *Leucas aspera* (Family: Lamiaceae) and *Tridax* sp. (Family: Asteraceae). *Mimosa pudica* was the most abundant weed plant in the survey locations. Other flora like *Mikania micrantha* (Family: Asteraceae), usually foraged by halictid bees, were seen in dried condition in the summer months. In location 11.628431/76.013756, the *Mimosa pudica* plants were found utilised as foliar cover to the nest entrance by *Seladonia* bees. Nests constructed under vegetation are said to have less chance of collapse and visit by kleptoparasites [8]. The same plant was also found foraged by the bees that inhabit beneath. *Apis cerana* and *Megachile* sp. were also found foraging on *Mimosa pudica*. Vishnu *et al.* [9] have recorded the visit of *Nomia crassipes* and *Nomia westwoodi* on this plant. This suggests that *Mimosa pudica* could be a usual pollen source for halictid bees. Other flowering plants reported to be foraged by *Seladonia* include *Erigeron annuus*, *Justicia procumbens* [10], marigold, rose, dahlia and cauliflower [4]. The crop and wild plants of Kerala with which the *Seladonia* bees can associate and help mutually have to be explored through detailed palynological studies.

Table 1 Geographic coordinates and ecosystem characteristics of sampling locations

Location	Coordinates	Ecosystem characteristics
Chelode	11.572673/76.040603	Tea estate
Vengapally	11.628431/76.013756	Stream bank
Vengapally	11.627094/76.032515	Stream bank
Cherupuzha Bridge, Mananthavady	11.803085/75.985858	Stream bank
Mananthavady	11.787481/76.002695	River basin

Halictid bees very often nest underground and sometimes on fallen logs. Therefore, the bees choose less disturbed or undisturbed ecosystems to inhabit. In this study, *Seladonia* bees and their nest were usually found along stream banks, which had hard lateritic soil. Cop fallows, which are subject to periodic tillage, were found uninhabited by *Seladonia* bees. Nests were usually found on land slopes. The entrances of these subterranean nests were devoid of any earthen mound. Foraging bees were found entering and exiting through the same nest opening. Nests of *Augochlora striata* studied by Packer *et al.* [11] were also concentrated on slopes and were covered with thin vegetation, stones or rocks. Packer *et al.* [11] have also explained the case of *Lasioglossum comugenense*, where the nest entrances were themselves sloping, probably to reduce water entry during rain.

Augochlora striata constructs a turret at the nest entrance out of the soil it digs [11]. Likewise, *Lasioglossum cinctipes* nests had a small sandy hump in place of the turrets. Such a turret or sandy hump was not found in the case of *Seladonia* bees in this study. The general nest architecture of halictid bees comprises a main tunnel with branches and brood cells arising from it. In the block of soil examined, which had a single nest, the main tunnel, at the nest opening, was not

perpendicular to the surface. The tunnels were very often elliptical in cross-section. The main tunnel was 0.4 to 0.6 cm at the entrance, and then it narrowed to 0.4 cm towards the inside. The main tunnel was divided into two branches at a distance of 4.5 cm from the entrance. The two branches made an angle of 120° and 130°, respectively, with the main tunnel. The angle between the branches was 70°. The random tunnels inside the soil block examined were usually 0.4 cm wide and could broaden to 0.5 – 0.6 cm at certain points. The perimeter of the cross-section of the tunnels ranged from 1.5 cm to 2.6 cm. The terminal end of the tunnel, designated to be brood cells, was about 0.6 cm in length and 0.6 – 0.7 cm wide [12].

CONCLUSION

Undisturbed habitats like stream banks harbour *Seladonia* bees. The nest site examined in this study was characterised by hard lateritic soils with clay loam texture and very high aggregate strength analysis. Such soil characteristics, added with the advantage of vegetative cover from plants like *Mimosa pudica*, may enable the bees to construct stable nests. Such ecosystems can harbour and conserve these ground-nesting bee fauna.

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