

## ECOLOGY OF DOMATIUM ASSOCIATED ANTS IN SOME SPECIES OF ACACIA

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### ЭКОЛОГИЯ ПОЛОСТЕЙ В НЕКОТОРЫХ ВИДАХ АКАЦИИ, СЛУЖАЩИХ УБЕЖИЩЕМ МУРАВЬЯМ

Симбиоз растений и муравьев, возникший в результате совместной эволюции, изучен для четырех видов акации. Установлено, что в колючках акации муравьи создают гнездовые камеры. Такие колючки были поделены на два типа: «гнездовые» и «негнездовые». «Гнездовым» присущи гиперплазия и гипертрофия, они демонстрируют анатомические и морфологические изменения. Муравьи обеспечивают их защиту и помогают в опылении. «Гнездовые» колючки служат жилищем не только муравьям, но и другим организмам.

*Ключевые слова:* акация, муравьи, гнездовые камеры, симбиоз.

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The Ant-plant mutualism resulted in co-evolution was studied in four different species of Acacias, and observed that ants make domatia in the thorns of Acacia. The thorns are classified into domatiate and non domatiate types. The domatiate thorns exhibit hyperplasia and hypertrophy, exhibit anatomical and morphological variations. The ants provide protection and help in pollination. The domatiate thorns provide dwelling place for the ants. The domatia vacated by the ants occupied by other organisms.

*Key words:* Acacia, Ant, domatia, mutualism.

The natural history of ant plant mutualism has fascinated scientists in the last two centuries. Though this association was proposed to be the result of Co-evolution (Redley, 1910), enough evidence for this concept was obtained only in the recent past (Gosta, 1985; Geneshaiah and Veena, 1988). Plants showing mutual relationship with ants were called myrmecophytes (Nair, 1969), while plant structures that could be used as nesting inhabiting sites were designated «domatia» (Wheeler, 1942). Domatia were well studied and described in detail in Central American and African species of Acacia (Mimosoidea, Leguminosae) by Janzen (1974). Very little work, however, has been done on this association on India Acacias (Geneshaiah and Veena, 1988). Hence this study was undertaken.

### MATERIALS AND METHODS

Four species of *Acacia* (Mimosoaceae), *A. leucopholea* (Roxb) Willd, *A. nilotica* (L.) Del., *A. horrida* (A.) Willd and *A. eburnea* (L.) Willd here selected for the study. Observations were done as plants growing in our university campus and nearby areas.

Transverse and longitudinal sections of normal and domatiate thorns were taken at different developmental stages and stained with Toluidine blue O, pH 4.4 (Krishnamurthy, 1988) for histological observations.

Behavioural and territoriality tests were conducted by releasing tagged ants between different domatiate thorns of the same plants as well as between those of different plants of the same species; ants specific to species of *Acacia* studied were also released onto other species of *Acacia*. The body wash of the ants was examined to study the role of ants as pollinators.

## OBSERVATIONS

The thorns of the species of *Acacia* studied by us can be classified into domatiate, temporary domatiate and nondomatiate types. The domatiate thorns are stout and swollen with an enlarged central cavity. They possess entrance and exit holes. Hence ants have a permanent dwelling, where they lay eggs and grow larvae and young ones. These cavities are large, irregular and occupy the entire central part all through the length of the domatium (Fig. 1 & 2). These cavities are formed by the damage to parenchyma and their eventual lyses by inhabiting ants. A few persisting parenchyma cells become hypertrophical and line the central cavity. Fungal mycelia are noticed intercellular in this zone. The temporary domatiate thorns are not used for raising the young ones and are slender. However, they have central cavities to which the ants visit domatia frequently. The purpose of the visit could not be ascertained with certainty. The nondomatiate thorns are slender, devoid of central cavities or entrance and exit, and have no association with ants and are distributed indiscriminately in all four species of *Acacia* studied.

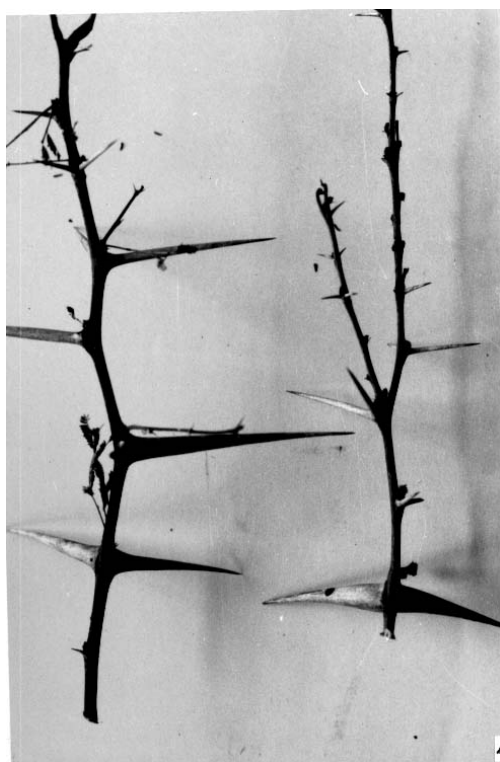


Fig. 1. Domatiate (enlarged) and non domatiate (nonenlarged) thorns of *Acacia eburnea* × 5

The ants collected from the thorns were identified as *Colobopsis pubescens* specific to *Acacia horrida*, which form domatiate thorns, *Sima allaborans* and *Phidole symthesi* restricted to *Acacia eburnea* in which thorns get enlarged and become stout, and *Phidole indica* which is a temporary associate of the *Acacia nilotica* and *A. leucopholea* thorns.

Ants always patrol the branches of plants with domatia, often visiting the flowers, as evidenced from the body wash containing anther and pollen grains. Probably, they inadvertently help in pollination. At the slightest disturbance they come out of thorns in large numbers, thus indirectly providing protection to the plant. This is also evident from the absence of other organisms in the branches containing domatiate thorns. The ants have established a strong territory in individual plants where they have made their domatium; the ants in a domatium are not specific to that domatium but can visit and stay in any other domatium of the same tree. However, they fail to occupy domatium of other plants of the same species. In other words ants of each plant make that plant as their territory.



Fig. 2. Entrance / exit hole of domatium thorns  $\times 5$

The domatium thorns discarded by the ants were often colonized by other organisms like fungi (*Aspergillus sps*), snail (*Stylommatophora*), spiders (*Orthognathd*) coleopteran beetles like Anthribidra, Hymenopterans like crambromids and larvae of lepidopteram insects.

## DISCUSSION

It is evident from the present study that the degree of mutualism between ants and *Acacia* species was highly variable. The interrelationships ranged from no association, temporary association and total mutualism with the evolution of domatium thorns in *A. ebumea* and *A. horrida*. The total mutualism has also been reported earlier between ants and species of *Acacia* in Central America and Africa (Janzen, 1974). The highly mutualistic relationship often results in affording protection form other groups of animals of the herbivores, predatory or parasite categories to the plant. The same observation was made earlier (Bentley, 1976; Tilmann, 1978). This is due to the establishment of a strong territory by the ants in the species of *Acacia* showing well developed domatium thorns. The patrolling of ants on the branches and constant vigil to disturbances also proves the same point. They also assist pollination between flowers of the same plant, thus helping the plant. The domatium thorns undergo hypertrophy and hyperplasy (several times larger than nondomatium thorns of the same plant) so as to accommodate the ants and their young ones. Although the ants are said to be not benefited much by this association (Beattie, 1985), our studies indicated that ants do benefit by this association. They not only get a habitat to live but also nutrients. Moreover, the ant domatium can serve as dwelling places for other organisms once the ants vacate such domatia (Hocking, 1970). In our studies also we were able to find a number of occupants. Thus ant *Acacia* interaction provides an interesting area for future studies on mutualism.

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