EXCELLENT PUBLISHERS

International Journal of Current Research in Biosciences and Plant Biology

ISSN: 2349-8080 (Online) • Volume 3 • Number 2 (February-2016)

Journal homepage: www.ijcrbp.com

Original Research Article

doi: http://dx.doi.org/10.20546/ijcrbp.2016.302.010

Bark Traits of Woody Species and Bark Resource Use by Faunal Community in Tropical Dry Evergreen Forest of India

K. Anil and N. Parthasarathy*

Department of Ecology and Environmental Sciences, Pondicherry University, Puducherry 605 014, India

Corresponding author.

Abstract

Bark can help to defend trees and lianas against abiotic and biotic disturbances. Bark traits have long been used to characterise tree fire resistance and physical features like texture, anatomy, fissure and sealing can influence the effectiveness of bark in protecting trees from fire, herbivory and microbial infections. We investigated bark traits of 105 woody species (60 trees and 45 lianas) in Indian tropical dry evergreen forest, and the relationship between bark thickness and sap quantity with faunal diversity, to assess the ecological use of bark resources as space and food by various fauna in tropical dry evergreen forest. Bark thickness of tree species in the studied forest varied from 0.02 to 2.23 ± 0.22 cm (maximum for *Garcinia spicata* and least for *Gmelina asiatica*) and those of lianas varied from 0.01 to 1.23 ± 0.02 cm (maximum for *Plecospermum spinosum* and least for *Cissus quadrangularis*). A total of thirteen species of tree nesters and five species of wood borers utilized bark resource in tropical dry evergreen forest and most common among them include termites (30.47 %) followed by ants and millipedes. The association between bark traits and faunal occurrence was analysed with principal component analysis (PCA) and trade-offs were ascertained with bivariate Pearson correlation. Evidently bark texture, fissure and thickness play a positive role in accommodating fauna ($p<0.01$) in tropical dry evergreen forest. The co-occurrence among bark faunal groups is also evident and the highest values of co-occurrence were recorded for ants – millipedes. Our results reveal that bark traits of woody species provide suitable habitat for wood borers and tree nesters. This study provides a ground work for further investigation on the functional aspects of bark in tropical woody species.

Article Info

Accepted: 28 January 2016
Available Online: 06 February 2016

Keywords

Bark fissure
Bark thickness
Faunal diversity
Sap quantity
Stem girth
Tropical dry evergreen forest

Introduction

Bark of woody species, as compared with other plant parts has been little studied besides its use in providing criteria for plant identification. The term bark designates all tissues external to the vascular cambium, comprising secondary phloem, periderm and nonconductive tissues external to the periderm (Evert et al., 2006). Whitmore (1962) introduced certain criteria for the identification and classification of different species on the basis of bark morphology. Bark can help to defend trees and lianas against various abiotic and biotic disturbances. Regardless of the nature of the disturbance, if bark plays an important role in defence, its thickness should increase asymptotically as an individual grows to certain extent and beyond this growth additional thickness confers no further survival advantage (Wilson and Witkowski, 2003). Bark traits have long been used to characterise tree fire resistance (Gorman, 1989; Agee, 1993). Physical features like texture, anatomy, fissure and sealing can influence the effectiveness of bark in protecting woody species from fire (Harmon, 1984; Vines, 1968), herbivory and microbial infections (Romberger et al., 1992). Jacobs (1988) observed that tropical forest trees with a thick bark or a bark rich in moisture such as *Eucalyptus* spp. have a better chance of withstanding fires. Apart from fire insulation, bark accomplishes many other functions including provision of structural support, reduction in water loss by stems, defence against herbivores, pathogens and injury by large mammals (Paine et al., 2010; Romero, 2013; Poorter et al., 2014).

Levin (1976) showed that bark of woody species in disturbed forests in Gabon was more frequently associated with toxic chemicals than the woody species characteristic of less disturbed forest. The threat posed to trees by pathogens and sap-feeding herbivores may also affect bark thickness. In the Neotropics, marmosets (*Callithrix* spp.) feed on exudates from holes they gouge in trees (Coimbra-Filho and Mittermeier, 1976). In North America, sapsuckers (*Sphyrapicus* spp.) extract sap from the extensive series of holes they bore through bark, preferentially selecting species that produce more sap (Eberhardt, 2000). Bark texture can influence the density, diversity and locomotion of both sessile and mobile organisms on tree bark in temperate forest (Cramer, 1975; Stephenson, 1989) and smooth texture bark on tree was hypothesized to be anatomical defences against insect attack (Ferrenberg and Mitton, 2014).

Wood-feeding insects attack live trees, which can create widespread disturbances in forests (Schowalter, 2000). In temperate forests, primary consumption by wood-boring insects can cause structural and functional disruption of primary and secondary growth of trees (Feller, 2002; Barbosa and Wagner, 1989) and can affect tree architecture, growth, reproduction and sex expression (Whitham and Mopper, 1985). Wood borers also play an important role in nutrient cycling, gap formation and succession in temperate ecosystem (Amman, 1976; Schowalter, 1981; Landquist, 2000). Wood borers can prune, weaken, or kill standing trees, thereby reducing the timber quality of both temperate and tropical species (Grijpma, 1970; Grijpma and Gara, 1970; Howard, 1991; Yamazaki et al., 1992). Barks hollowed by wood borers are used as nest site by ants and spiders, as food sources by numerous dead wood feeders and as a host site for parasites (Feller and Mathis, 1997).

At the community-level, few studies are available regarding the bark characteristics (Pinard and Huffman, 1997; Hegde et al., 1998; Paine et al., 2010; Poorter et al., 2014). Tropical dry evergreen forests (TDEF) are found along the east coast of India and mostly occur as small, isolated fragments of varying sizes (0.5 to ≈10 ha) in peninsular India. Plant diversity is well documented in these forests (Parthasarathy et al., 2008), but intensive ecological studies critical for conservation and for planning restoration activities are warranted. There have been no studies on bark traits and faunal occurrence at the community level in TDEF and hence this research was undertaken in the less-studied tropical dry evergreen forest on the Coromandel Coast of peninsular India. We studied bark traits and faunal utilization of 105 woody species: sixty trees and forty- five lianas in fragments of TDEF in southern India, as to assess the ecological use of bark as a resource for space and food by various fauna. We addressed two questions: first, how are bark traits and bark faunal groups related? Second, what is the importance of bark as a resource in forest ecosystem? We hypothesised that (i) there is a positive relationship between bark traits and bark faunal groups and (ii) bark and bark faunal groups play significant role in forest ecosystem.

Materials and methods

Study area

The terrestrial vegetation distributed along the east coast of India is described as tropical dry evergreen forest which inland up to 50 km (Champion and Seth 1968; Mani and Parthasarathy 2006; Parthasarathy et al., 2008). These closed-canopy forests have two distinct layers of tree species. The canopy is about 10–12 meter in height, dominated by large trees such as *Pterospermum canescens* and *Garcinia spicata*, while the sub-canopy is composed of smaller trees such as *Memecylon umbellatum* and *Canthium dicoccum*. For the present study, we selected a total of nine tropical dry evergreen forest sites, as to cover all woody plant species of TDEF. These sites are located in Villupuram (11°56′ N and 79°53′ E) and Cuddalore (11°43′ N and 79°49′ E)) districts of Tamil Nadu on the Coromandel Coast of peninsular India. Site Puthupet (PP- 12°03’ N and 79°52′ E), Oorani (OR- 12°09′ N and 79°52′ E) and Vada Agaram (VA- 72°10′ N and 79°55′ E) are located respectively 15, 28 and 32 km north of Puducherry (11°56′ N and 79°53′ E) and seven other sites Kuzhandhaikuppam (KK- 11°43′ N and 79°38′ E), Thirumanikkuzhi (TM- 11°43′ N and 79° 41 E), Suriyanpet (SR- 11°44′ N and 79°38′ E), Sendhirakillai (SK- 11°30′ N and 79°41 E), Palvathunnan (PT-11°32′ N and 79°41′ E) and Kothattai (KT- 11°30′ N and 79°42′ E) are located around 45 to 50 km south of Puducherry. The forest area of each study site ranges from 1.2 to 10 ha. Fifty-year (1954 to 2014) climate data of the ten sites revealed a mean annual temperature of 28.3ºC and the mean annual rainfall of 1,171 mm (www. world clim.com). The mean number of rainy days in the annual cycle is 55.5. The climate is tropical dissymmetric type with the bulk of the rainfall received during the northeast monsoon (October-December). Soils are red ferralitic belonging to the Cuddalore sandstone formation of the Miocene period (Meher-Homji, 1974). Major tree species of this forest type include *Memecylon umbellatum* Burm. f., *Garcinia spicata* (Wight & Arn.) J.D. Hook., *Tricalysia sphaerocarpa* (Dalz.) Gamble, *Lepisanthes tetraphylla* (Vahl) Radlk., *Atalantia monophylla* (L.) Correa and *Pterospermum canescens* Roxb., and major lianas include *Strychnos lenticellata* Dennst., *Combretum albidum* G. Don., *Reissantia indica* (Willd.) Halle, *Pyrenacantha volubilis* Wight and *Capparis zeylanica* L.; *Ecbolium viride* (Forsskal) Alston and *Sansevieria roxburghiana* Schultes & Schultes f. are the major native perennial herbs present in this forest type (Parthasarathy et al., 2008).

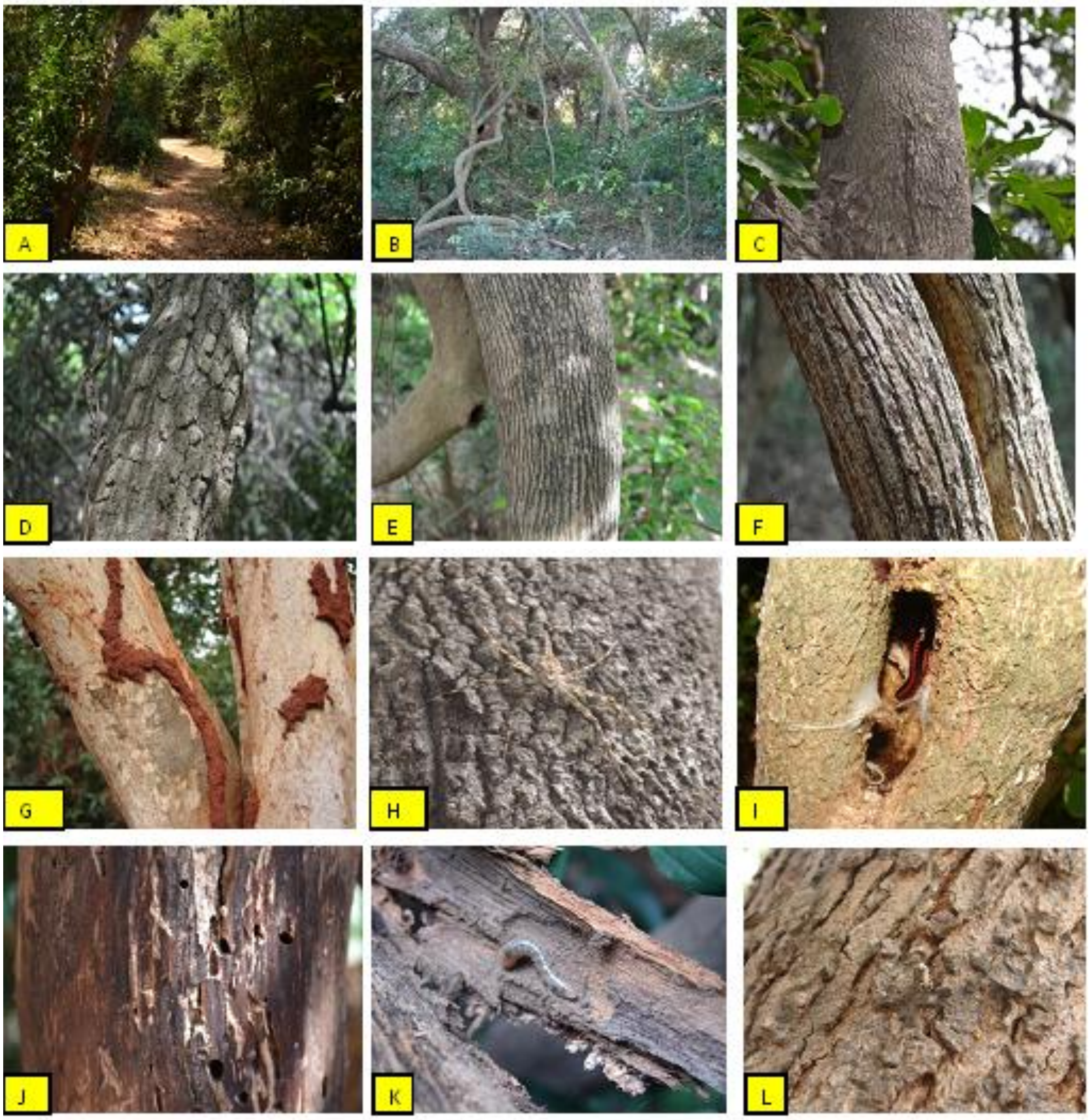

Fig. 1: Photograph depicting view of study site, forest stand view, bark of woody species exhibiting a range of bark traits and bark resource users in the tropical dry evergreen forest on the Coromandel Coast of India. (A) Purangani forest view. (B) Oorani forest interior. (C) Rough bark of *Diospyros ebenum*. (D) Rough bark of *Morinda coreia*. (E) Slightly rough bark of *Memecylon umbellatum*. (F) Slightly rough bark of the liana *Reissantia indica.* (G) *Cryptotermes* sp. on smooth-barked tree, *Tricalysia sphaerocarpa*. (H) *Hersilia savignyi* (bark spider) on *Diospyros ebenum*. (I) *Xenobolus carnifex* (Millipedes) in *Garcinia spicata*. (J) Holes made by *Xylocopa* sp. in *Lepisanthes tetraphylla*. (K) *Indarbela quadrinotata* in *Lepisanthes tetraphylla.* (L) Bark spider and juvenile scorpion on *Albizia amara* bark.

Data collection

Bark traits of a total of 105 woody species (60 trees and 45 lianas) of tropical dry evergreen forest and faunal occurrence on them were studied in 2012 to 2014 (Appendix 1, Fig. 1). A minimum of 2 to 4 individuals for each species (for rare and sub-dominant species) to a maximum of 10 individuals (for dominant species) were sampled for all trees (≥ 10 cm girth at breast height) and lianas (≥ 3.1cm girth measured at 130 cm from the rooting point). The sampling involved measurement of girth and removal of a piece of bark (3 cm^2) of trees and lianas from the base of the stem, for avoiding thorns and other protuberance point. Bark of woody species was sampled for a total of 605 individuals of trees and lianas, from which totally 2420 bark samples were taken. Bark texture and surface were visually assessed in the field and bark thickness was measured using digital Vernier caliper to the nearest of 0·1 mm. The term 'bark' is often loosely used to describe everything external to the wood, for because in practice it is difficult to measure thickness of each individual layer of bark. Hence, the thickness reported here is a gross measure of all tissues external to wood. We applied the criteria of Whitmore (1962) and Yunus et al. (1990) to characterise bark traits. The occurrence of exudations like gums, resins and latex as shown by the liquid exuding from the localized zones of the cut bark as well as older injuries, was also recorded in the field. The nature of the exudation was also confirmed by referring to the available literature (Troup 1921, Council for Scientific & Industrial Research 1956–66, Gamble and Fischer, 1915-35). The major bark resource users as tree nesters and the wood boring xylovores were collected (for identification) in vials containing 80% ethanol and in addition captured in photos and videos in bark habitat or while they were feeding on them. Bark was removed and holes in the wood also investigated for the presence of faunal group and they were collected by net traps, hand picking or bottle traps. Fauna were identified by using various field guides and available literature (Alagesan and Ramanathan, 2013; Mishra, 1991).

Results

Variation in bark thickness

Bark thickness of 105 woody plant species (60 trees and 45 liana species) of Indian tropical dry evergreen forest ranged from 0.01 to 2.23 ± 0.22 cm for the total of 2420 bark samples obtained from 605 individuals (Appendix 1). Bark thickness of the 60 tree species (stem circumference range 6 to 241.2 cm) varied from 0.02 to 2.23 ± 0.22 cm and those of lianas (stem circumference range 3.1 to 45.7 cm) varied from 0.01 to 1.23 ± 0.02 cm. Among the 60 tree species the mean bark thickness was maximum for the evergreen species *Garcinia spicata* (1.63 cm) and least for the deciduous species *Gmelina asiatica* (0.02 cm). Among the 45 liana species the mean bark thickness was maximum for the thorny straggler *Plecospermum spinosum* (0.83 cm) and least (0.01cm) for the tendril climber *Cissus quadrangularis* (Appendix 1).

Table 1. Bark faunal diversity in tropical dry evergreen forest on the Coromandel Coast of India.

Life-style	Faunal group	Family	Species
Tree nesters	Termites	Kalotermitidae	*Cryptotermes* sp.
	Ants	Formicidae	*Camponotus* sp.
			Oecophylla samaragdina
	Wasps	Vespidae	*Polistes* sp.
	Bees	Apidae	*Apis florea*
			Xylocopa sp.
	Spiders	Hersiliidae	*Hersilia savignyi*
			Poecilothemia regalis
			Poecilothemia striata
			Herennia ornatissima
	Scorpions	Buthidae	*Mesobuthus tamulus* *
		Scorpionoidea	*Heterometrus flavimanus**
	Millipedes	Pachybolidae	*Xenobolus carnifex*
Wood borers	Termites	Kalotermitidae	*Cryptotermes* sp.
	Jewel beetle	Buperestidae	*Sternocera chrysis*
	Longhorn beetles	Cerambycidae	Unknown sp.
	Carpenter bees	Apidae	*Xylocopa* sp.
	Larvae	Cossidae	*Indarbela quadrinotata*

* Juvenile

Bark trait, sap feature and faunal assemblage

In Indian tropical dry evergreen forest, the most common bark texture was rough (51.42%) with deep fissures (72%) (Appendix 1). About 28.57% of species had slightly rough bark followed by smooth texture (20%). Of the total 105 species studied, 22 species possessed sap and among them the predominant (50%) sap type was latex, followed by resin (31.8%) and gum (18.2%). The most common sap colour was milky white (41%) and other colours include red, black, yellow and watery (Appendix 1). A total of thirteen species of tree nesters and five species of wood borers were observed in the tropical dry evergreen forest (Table 1). Among the fauna recorded from the 105 woody species, the most common bark resource users were termites, which utilised 32 (30.47 %) of the plant species followed by ants and millipedes (Appendix 1). The association between bark traits and faunal occurrence was analysed with principal component analysis (PCA). The first PCA axis explained 32.5% of the variation and it shows a trade-off between bark thickness, girth and faunal occurrence on the left vs. texture and fissure of bark on the right (Fig. 2). The second PCA axis explained 17.6% of the variation and shows a trade-off between faunal occurrence and bark texture at the top of the second PCA axis vs. stem girth and thickness of bark at the bottom. The same relationships and trade-offs were obtained with bivariate Pearson correlation (Table 2), for various faunal groups:

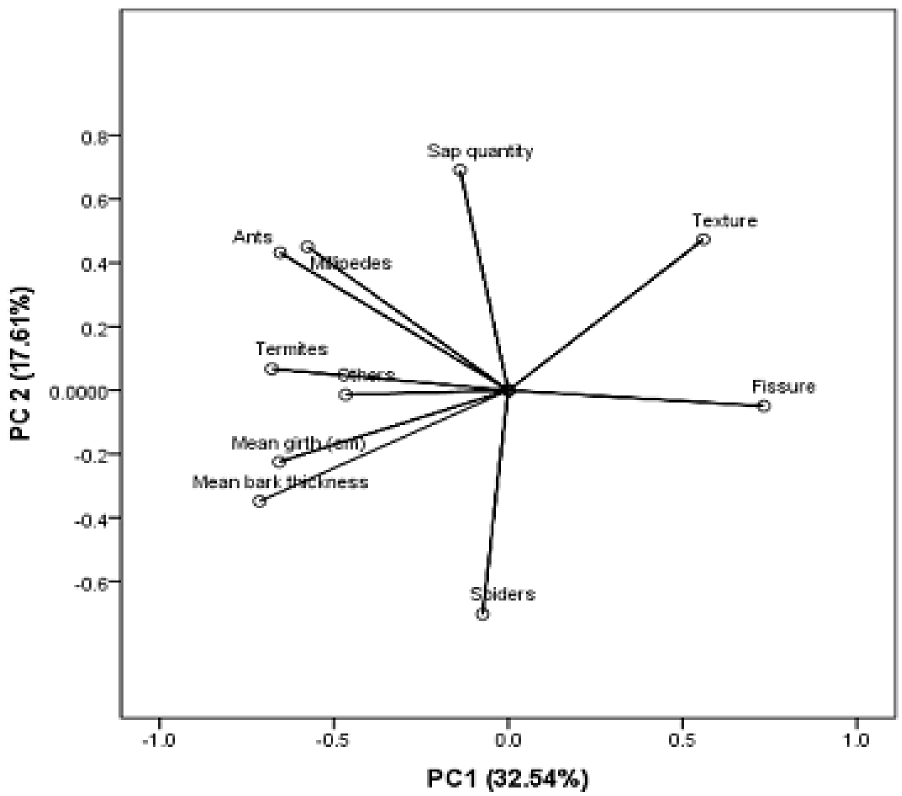

Fig. 2: Principal component analysis of wood and bark traits. The first two principal components explained 50.16 % of observed variation.

Termite: We found a negative relationship of termite attack with evergreen species and a positive relationship with deciduous species. Bark thickness and texture (rough and deeply fissured) play a positive role in accommodating termites. Smooth and 'entire' type of bark provides resistance to termite attack (Table 2).

Ant: Bark thickness, sap quantity (scanty) and texture of deeply fissured type play a positive role in accommodating ant fauna. A weak positive relationship was obtained between rough bark and ant fauna. Whereas a negative relationship existed between 'entire' (non-fissured) bark type and ant fauna (Table 2).

Millipede: There is a positive relationship between stem girth and deeply fissured bark for millipede habitat and a negative relationship existed with 'entire' bark type and millipedes (Table 2).

Table 2. Pearson correlation between bark traits of woody species and faunal occurrence. Below the diagonal correlations pooled for 105 plant species are presented (Plant-type: E-evergreen, B-brevi-deciduous, D-deciduous; Sap quantity: S- scanty; M- moderate; NS- no sap; Texture: R-rough, SR-slightly rough, S-smooth; Fissured: D-deep, S-shallow, E-entire).

Faunal group	E	B	D	Mean girth	Mean thickness	NS	Sca	Mod	S	SR	R	DF	SF	E
Termite	**-0.220***	0.083	**0.193***	**0.208***	**0.366****	0.101	-0.003	-0.123	**-0.228***	-0.144	**0.312****	**0.439****	0.045	**-0.325****
Ants	-0.117	0.108	0.032	0.185	**0.301****	-0.123	**0.265****	-0.082	-0.121	-0.167	**0.248***	**0.396****	-0.043	**-0.215***
Millipedes	-0.063	0.069	0.006	**0.195***	0.073	0.045	0.122	-0.165	-0.090	-0.106	0.168	**0.338****	0.009	**-0.229***
Spider	0.012	-0.067	0.059	0.081	0.175	**-0.290****	-0.023	**0.385****	-0.116	-0.174	**0.250***	0.094	0.033	-0.083
Scorpion	-0.028	-0.076	0.121	-0.022	-0.052	0.074	-0.045	-0.052	0.105	-0.088	-0.004	0.142	-0.101	0.001
Larvae	-0.041	0.010	0.041	**0.199***	**0.322****	-0.015	-0.065	0.076	-0.100	-0.126	**0.193***	**0.345****	-0.039	**-0.197***
Wasp	-0.028	0.090	-0.063	0.047	-0.004	0.074	-0.045	-0.052	-0.070	0.066	-0.004	-0.057	0.046	0.001
Bee	0.114	-0.076	-0.063	**0.248***	**0.441****	-0.095	-0.045	0.159	-0.070	-0.088	0.135	-0.057	0.046	0.001
Beetle	0.023	-0.093	0.074	**0.194***	0.102	0.091	-0.056	-0.064	0.057	-0.108	0.052	**0.257****	-0.124	-0.056

Significant correlations ($p<0.05$) are given in bold and correlations with $p<0.001$ are in bold and underlined.

Table 3. Jaccard similarity index of bark faunal diversity and co-occurrence in tropical dry evergreen forest on the Coromandel Coast of India.

	Termite	Ant	Millipede	Spider	Scorpion	Larva	Wasp	Bee	Beetle
Termite		62.069	48.9796	22.2222	11.7647	22.2222	11.7647	11.7647	11.4286
Ant			**65.1163**	**5.1282**	7.1429	26.6667	7.1429	14.2857	6.8966
Millipede				13.3333	0	19.0476	10.5263	10.5263	20
Spider					0	0	0	0	12.5
Scorpion						33.3333	0	0	0
Larva							0	33.3333	28.5714
Wasp								50	0
Bee									0
Beetle									

Spider: Spider fauna show a strong positive relationship with sap producing plant species and an opposite trend with sap-lacking species. There is also a positive relationship with rough- surfaced bark for accommodating spider fauna (Table 2).

Others: Beetle larvae and bees show a positive relationship with stem girth and bark thickness. Further, beetles and beetle larvae show a positive relationship with deeply fissured bark, and larvae show a negative relationship with 'entire' bark. There is no significant relationship between bark traits and other faunal groups (scorpion and wasp). Evidently, bark texture, fissure and thickness play a positive role in accommodating faunal group in tropical dry evergreen forest.

Bark faunal diversity and their co-occurrence: Wood boring insects were prevalent in tropical dry evergreen forest (Table 1). The major bark resource users as tree nesters include termites, ants, wasps, bees, scorpions, and millipedes. The wood boring xylovores include beetle larvae, lepidopteron larvae, carpenter bees and beetles. The co-occurrence among bark faunal groups is also evident (Table 3). The highest values of co-occurrence were recorded for ants - millipedes and termites - ants and to lesser extent between termites – scorpions, termites - bees and termites - wasp.

Discussion

Many factors are related to bark thickness including species in question, position along the stem, tree health, fire history, etc. (Gill, 1995). In this study, bark thickness was positively related to stem diameter for all species. A comparison of bark thickness of various tropical forests revealed that the bark thickness of woody species of Indian tropical dry evergreen forest is lesser than those reported in other forests: the mean bark thickness of woody species is 0.30 cm in tropical dry evergreen forest is about five to six fold less than those of Bolivian savannah species (1.44 cm; Pinard and Huffman, 1997) and other inland forests in India (1.80 cm; Yunus et al., 1990).

The relatively high humidity coupled with the absence of fire incidence in Indian tropical dry evergreen forest (TDEF) would not have provided any trigger for developing greater bark thickness. The positive relationship obtained between stem size class and trunk bark thickness can be attributed to its natural defensive role. In TDEF, bark thickness showed no relationship with sap quantity, but we observed a significant relation between sap quantity and faunal habitation, mostly accommodating spiders.

Tree species rich in anti-feedants such as gum, resin, tannin and lignin are often relatively resistant and furthermore, investment in certain chemical defence such as latex can lead to specialisation by certain herbivorous taxa (Tavakilian et al., 1997) as exemplified by termites (*Cryptotermes* sp.) attack in *Garcinia spicata*, *Ficus benghalensis*, *Manilkara hexandra*, *Mimusops elengi* and *Pterospermum canescens* in our study sites (Appendix 1). Dry wood termites live entirely within the wood, do not need to maintain a connection with the ground or soil and do not absolutely require free water, but some species such as C. *brevis* will not survive under conditions of high humidity or water content in wood (Collins, 1969). Dry wood termites can invade live trees by attacking their bark which could degrade the value of timber species where dry wood termites live. There is a certain degree of host specificity in termite and about 73 plant species claimed resistance to termite attack. Bark texture plays a major role in accommodating various fauna in our study and rough bark provides good shelter for various fauna except for three families (Capparaceae, Verbenaceae and Vitaceae). Thus, biotic and abiotic threats seem to be the most important factors shaping bark thickness, chiefly for defensive function.

Bark must simultaneously perform many functions; no single function emerges as dominant influence on thickness. Plant traits play a major role in faunal diversity. Thicker barked and fissured plants become a habitat for tree nesters and wood borers. Barks hollowed by the wood borers are also used as nest sites by ants (as food source), spiders (as a prey site) and millipedes (as refuge or shelter). The *Oecophylla samaragdina* workers are also particularly effective in hunting insects that feed on the tissue and sap of tree (Bharti and Silla, 2011). Millipedes constitute one of the major groups of soil and litter fauna in tropical and temperate environments; they play an important role in energy flow and circulation of minerals in terrestrial ecosystems (Alagesan and Muthukrishnan, 2005). *Xenobolus carnifex* feeds exclusively on dead and decaying vegetation and also use their thicker bark as shelter. It should also be noted that there are other various potential functions that the bark plays. In our study we found the ecological use of bark as a resource for space and food by various fauna: wood-feeding insects attack live trees, which in turn create widespread disturbances in the forest (Schowalter, 2000). Wood borer damage meristem and shoots which may severely alter a plant's form (Whitham and Mopper, 1985; Schowalter, 2000). The bark caterpillar, *Indarbela quadrinotata* attacks a variety of tree species in TDEF. Specialised conditions are required for the establishment of wood borers (Mishra, 1991); in our observation it mainly attacks older trees having thicker bark like *Garcinia spicata* and *Lepisanthes tetraphylla.* Among various factors, bark thickness of the tree is also important. The history of such damage can be inferred from tree shape and other enduring evidences on branches and boles like feeding galleries, exit holes, and tannin stains (Oliver and Larson, 1996). On the ecosystem level, wood borers potentially impact nutrient cycling process by altering both the quantity and quality of the litter (Feller, 2002). Furthermore, wood borers such as termites (Isopteran), jewel beetles (Buperestidae), longhorn beetles (Cerambycidae) and carpenter bees (Xylocopidae) in tropical dry evergreen forest provide habitat for many species of ants (Formicidae), wasp (Vespidae), bees (Apidae) and other arthropods. Results from various studies suggest that primary consumption level of wood boring insects may also modify forest dynamics and nutrient cycling process. These data suggest that barks play an important role in TDEF by providing suitable habitat for wood borers and numerous tree nesters.

In this study the highest values of co-occurrence were recorded for ants – millipedes because some millipedes form mutually beneficial relationship with ants or termites. The insect protect them from predators and the millipedes perform housekeeping duties for them by eating fungi and detritus in their nests. The most constant and widespread enemies of termites are ants and so the termite – ant association is also high in TDEF. Termites are very weak and fragile and this can be easily overpowered by ants and other predators, and they block off the entry tunnels by using their jaws or chemical weaponry as a formidable defence (Dejean and Feneron 1999). Ants and termites are eusocial insects that live in extended colonies and have a significant influence on the surrounding ecosystem. Termites feed on detritus material and thus play a major role in decomposition processes, nutrient cycling and carbon processing (Eggleton et al., 1997; Jones and Eggleton, 2000). Bark as a habitat with its hard dead tissue on live tree species, reduces as such the palatability to many fauna, but supports as a habitat particularly those species which harbour rough and fissured bark. All these together account for low bark faunal diversity recorded in the TDEF. The termites (with their innate ability to digest hard tissues) have an advantage in utilizing bark as food and habitat than other faunal groups.

Conclusion

This study investigated the functional aspects of bark as habitat and food source for faunal groups in the understudied tropical dry evergreen forest (TDEF) of India and such baseline research on plant resource use by animal communities will be valuable in understanding the complex forest biotic interactions useful for conservation of this and similar tropical forests. The tropical dry evergreen forest has a restricted geographical distribution and one of the world's low diversity forests, but subjected to various anthropogenic disturbances. This calls for greater attention to preserve the remaining patches of this forest type to save the biodiversity with the involvement of local people. Yet, the tropical dry evergreen forest supports a rich insect and avifauna, many of which help in forest ecosystem functioning (pollination and seed dispersal etc.) of tropical dry evergreen forest. This region's characteristic flora is not only a shelter for faunal community, but also has a rich cultural tradition associated with it as the TDEF sites are also the sacred groves. Therefore, we recommend a community-level approach for forest conservation with the involvement of local people and it is important that the local inhabitants realize the values of these patches of forest and make low levels of resource use from the forest.

Conflict of interest statement

Authors declare that they have no conflict of interest.

Acknowledgement

K. Anil thanks Pondicherry University for financial support received through UGC University fellowship.

References

Agee, J. K., 1993. Fire ecology of Pacific Northwest forests.Island Press, Washington DC.490 p.

Alagesan, P., Muthukrishnan, J., 2005. Bioenergetics of the household millipede pest, *Xenobolus carnifex* (Fabricius, 1775) (Diplopoda: Spirobolida). Peckiana 4, 3-14.

Alagesan, P., Ramanathan, B., 2013. Diversity of Millipedes in Alagar Hills Reserve Forest in Tamil Nadu, India. Int. J. Biodiv. Article ID 715460, 5 p. http://dx.doi.org/10.1155/2013/715460.

Amman, G. D., 1977. The role of the mountain pine beetle in lodge pole pine ecosystems: impact on succession. In: The Role of Arthropods in Forest Ecosystems (Ed.: Mattson, W. J.). Springer, Berlin. pp.3-18.

Barbosa, P., Wagner, M. R., 1989. Introduction to Forest and Shade Tree Insects. Academic Press Inc., San Diego.

Bharti, H.,Silla, S., 2011. Notes on life history of *Oecophylla smaragdina* (Fabricius) and its potential as biological control agent. Halteres 3, 57-64.

Champion, H. G., Seth, S.K., 1968. A Revised Survey of the Forest Types of India. Govt. of India Press, Delhi.

Coimbra-Filho, A. F., Mittermeier, R. A., 1976. Exudate-eating and tree-gouging in marmosets. Nature 262, 630.

Collins, M. S., 1969. Water relations in termites. In: Biology of Termites (Eds.: Krishna, K., Weesner, F. M.). Vol. I. Academic Press, New York. pp.433-458.

Council for Scientific and Industrial Research. 1956-66. The Wealth of India, Raw Materials. CSIR, New Delhi.

Cramer, M.B., 1975. Corticolous lichens of riparian deciduous trees in the central Front Range of Colorado. Bryologist 78, 44-56.

Dejean, A., Feneron, R. 1999. Predatory behaviour in the ponerine ant, *Centromyrmex bequaerti*: a case of termitolesty. Behav. Processes. 47, 125-133.

Eberhardt, L. S. 2000. Use and selection of sap trees by yellow-bellied sapsuckers. The Auk. 117, 41-51.

Eggleton, P., Homathevi, R., Jeeva, D., Jones, D.T., Davies, R.G., Maryati, M., 1997. The species richness and composition of termites (Isoptera) in primary and regenerating lowland dipterocarp forest in Sabah, East Malaysia. Ecotropica. 3, 119-128.

Evert, R., Esau, K., Eichhorn, S. 2006. Esau's Plant Anatomy: Meristems, Cells, and Tissue of the Plant Body: Their structure, Function, and Development. Wiley-Liss, Hoboken, New Jersey.

Feller, I. C., 2002. The role of herbivory by wood-boring insects in mangrove ecosystems in Belize. Oikos. 97, 167-176.

Feller, I. C., Mathis, W. N., 1997. Primary Herbivory by Wood-Boring Insects along an Architectural Gradient of Rhizophora mangle. Biotropica. 29, 440-451.

Ferrenberg, S., Mitton, J. B., 2014. Smooth bark surfaces can defend trees against insect attack: resurrecting a 'slippery' hypothesis. Funct. Ecol. 28(4), 837–845.

Gamble, J. S., Fischer, C. E. C., 1915-1935. Flora of the Presidency of Madras. Vols. I-III, Adlard & Son., London.

Gill, A. M., 1995. Stem and fire. Plant Stems: Physiology and Functional Morphology (Ed.: Gartner, B. L.). Academic Press, San Diego. pp.323-342.

Gorman, M. W., 1989. Eastern part of Washington Forest Reserve. USDA Geological survey, 19th annual report, Part V: Forest Reserves. Government Printing Office, Washington DC. pp.315- 350.

Grijpma, P., 1970. Studies on the shoot borer *Hypsipyla grandella* (Zeller) Lep. Pyralidae.Vol 1. Miscellaneous Publications No. 101. Institutio Interamericado de CienciasAgricolas. Turrialba, Costa Rica.

Grijpma, P., Gara, R. I., 1970. Studies on the shoot borer *Hypsipyla grandella* Zeller. I. Host selection behavior. Turrialba. 20, 233–240.

Harmon, M. E., 1984. Survival of trees after low-intensity surface fires in Great Smoky Mountains National Park. Ecology. 65, 796-802.

Hegde, V., Chandran, M. D. S., Gadgil, M., 1998. Variation in bark thickness in a tropical forest community of Western Ghats in India. Funct. Ecol. 12, 313-318.

Howard, F. W., 1991. Seasonal incidence of shoot infestation by mahogany shoot borer (Lepidoptera: Phycitidae) in Florida. Florida Entomol. 74, 150–151.

Jacobs, M., 1988. The Tropical Rain Forest. A First Encounter. Springer-Verlag, Berlin.

Jones, D.T., Eggleton, P., 2000. Sampling termite assemblages in tropical forests: testing a rapid biodiversity assessment protocol. J. Appl. Ecol. 37, 191–203.

Levin, D. A., 1976. Alkaloid-bearing plants: an ecogeographic perspective. Amer. Nat. 110, 261-284.

Lundquist, J. E., 2000. A method of estimating direct and indirect effects of *Armillaria* root disease and other small-scale forest disturbances on canopy gap size. For. Sci. 46, 356-362.

Mani, S., Parthasarathy, N., 2006. Tree diversity and stand structure in inland and coastal tropical dry evergreen forests of peninsular India. Curr. Sci. 90, 1238–1246.

Meher-Homji, V. M., 1974. On the origin of tropical dry evergreen forest of south India. Int. J. Ecol. Env. Sci. 1, 19-39.

Mishra, S.C., 1991. Effect of temperature and relative humidity on consumption and digestion of food (bark) by larvae of *Indarbela quadrinotata* Wlk. (Lepidoptera: Indarbelidae). J. Entomol. Res. Soc. 15, 287-293.

Oliver, C. D., Larson, B. C., 1996. Forest Stand Dynamics. John Wiley and Sons, New York.

Paine, C. E. T., Stahl, C., Courtois, E. A., Patiño, S., Sarmiento, C., Baraloto, C., 2010. Functional explanations for variation in bark thickness in tropical rain forest trees. Funct. Ecol. 24, 1202-1210.

Parthasarathy, N., Selwyn, M.A., Udayakumar, M., 2008. Tropical dry evergreen forests of peninsular India: ecology and conservation significance. Trop. Conserv. Sci. 1, 89–110.

Pinard, M. A., Huffman, J., 1997. Fire resistance and bark properties of trees in a seasonally dry forest in eastern Bolivia. J. Trop. Ecol. 13, 727-740.

Poorter, L., McNeil, A., Hurtado, V., Prins, H. T., Putz, F. E., 2014. Bark traits and life-history strategies of tropical dry- and moist forest trees. Funct. Ecol. 28, 232–242.

Romberger, J. A., Hejnowicz, Z., Hill, J. F., 1992. Plant Structure, Function and Development. Springer-Verlag, Berlin.

Romero, C., 2013. Bark: structure and functional ecology. Bark: Use, Management, and Commerce in Africa (Eds.: Cunningham, A. B., Campbell, B. M., Luckert, M. K.). Advances in Economic Botany, 17. The New York Botanical Garden Press, Bronx. pp.5–25.

Schowalter, T. D., 1981. Insect herbivore relationship to the state of the host plant: biotic regulation of ecosystem nutrient cycling through ecological succession. Oikos. 37, 126-130.

Schowalter, T. D., 2000. Insect Ecology: An Ecosystem Approach. Academic Press, Orlando.

Stephenson, S.L., 1989. Distribution and ecology of myxomycetes in temperate forests. II. Patterns of occurrence on bark surface of living trees, leaf litter, and dung. Mycologia. 81, 608-621.

Tavakilian, G., Berkov, A., Meurer-Grimes, B., Mori, S., 1997. Neotropical tree species and their faunas of *Xylophagous longicorns* (Coleoptera: Cerambycidae) in French Guiana. Bot. Rev. 63, 303–355.

Troup, R. S., 1921. The Silviculture of Indian Trees. Clarendon Press, Oxford.

Vines, R. G., 1968. Heat transfer through bark and the resistance of trees to fire. Aust. J. Bot. 16, 499-514.

Whitham, T. G., Mopper, S., 1985. Chronic herbivory: impacts on architecture and sex expression of pinyon pine. Science 228, 1089-1091.

Whitmore, T. C., 1962. Studies in systematic bark morphology I. Bark morphology in Dipterocarpaceae. New Phytol. 61, 191.

Wilson, B. G., Witkowski, E. T. F., 2003. Seed banks, bark thickness and change in age and size structure (1978–1999) of the African savanna tree, Burkeaafricana. Plant Ecol. 167, 151-162.

Yamazaki, S., Ikeda, T., Taketani, A., Vasquez Pacheco, C.Sato, T., 1992. Attack by the mahogany shoot borer, *Hypsipyla grandella* Zeller (Lepidoptera: Pyralidae), on the Meliaceous trees in the Peruvian Amazon. Appl. Entomol. Zool. 27, 31–38.

Yunus, M., Yunus, D., Iqbal, M., 1990. Systematic bark morphology of some tropical trees. Bot. J. Linn. Soc. 103, 367-377.

APPENDIX I. : Bark traits and resource use by faunal community in tropical dry evergreen forest on the Coromandel Coast of India (Lf- Life-form : T- tree, L - liana; Plant-type: E-evergreen, B-brevi-deciduous, D-deciduous; Sap quantity: S- scanty; M- moderate; NS- no sap; Texture: R-rough, SR-slightly rough, S-smooth; Sap colour: M-milky, W-watery, Y-yellow, R-red, NA-not applicable; Fissured: D-deep, Di-dippled, S-smooth, E-entire; Bark fauna: Te-termite, La- larvae, Bt- beetle, An- ants, Wa- wasp, Be- bee, Sp- spider, Sc- scorpion, Mi- Millipede).

APPENDIX I. Bark traits and resource use by faunal community in tropical dry evergreen forest on the Coromandel Coast of India (Lf- Life-form : T- tree, L - liana; Plant-type: E-evergreen, B-brevi-deciduous, D-deciduous; Sap quantity: S- scanty; M- moderate; NS- no sap; Texture: R-rough, SR-slightly rough, S-smooth; Sap colour: M-milky, W-watery, Y-yellow, R-red, NA-not applicable; Fissured: D-deep, Di-dippled, S-smooth, E-entire; Bark fauna: Te- termite, La- larvae, Bt- beetle, An- ants, Wa- wasp, Be-bee, Sp- spider, Sc- scorpion, Mi- Millipede).

Sl. no.	Plant species	Family	Plant type	Sample size	Mean girth (cm)	Mean bark thickness (cm)	Sap quantity	Texture	Sap colour	Fissure	Fauna
								R/SR/S	M/W/Y/N/R	D/Di/S/E	
	Trees										
1	*Aglaia elaeagnoidea* (Juss.) Benth.	Meliaceae	E	4	85.3	0.15	NS	R	NA	S	
2	*Albizia amara* (Roxb.) Boivin	Mimosaceae	D	10	60.26	0.26	NS	R	NA	D	Te, An, Sc, La
3	*Albizia lebbeck* (L.) Benth.	Mimosaceae	D	4	114.2	0.42	NS	R	NA	D	Te, Bt, Sp,Mi
4	*Allophyllus serratus* (Roxb.) Kurz.	Sapindaceae	E	4	114.2	0.13	NS	S	NA	E	
5	*Atalantia monophylla* (L.) Correa	Rutaceae	E	8	39.18	0.26	NS	R	NA	S	Te,Mi
6	*Azadirachta indica* A. Juss.	Meliaceae	B	5	59	0.331	NS	R	NA	S	
7	*Barringtonia acutangula* (L.) Gaertner	Barringtoniaceae	E	4	92.4	0.35	NS	S	NA	E	Bt
8	*Bauhinia racemosa* Lam.	Caesalpiniaceae	D	4	33.6	0.12	NS	SR	NA	S	Te,Mi
9	*Benkara malabarica* (Lam.) Tirven.	Rubiaceae	E	4	16.2	0.1	NS	SR	NA	E	
10	*Breynia vitis-idaea* (Burm. f.) Fischer	Euphorbiaceae	E	4	44.7	0.13	NS	SR	NA	Di	
11	*Butea monosperma* (Lam.) Taubert	Papilionaceae	D	4	98.3	0.86	NS	R	NA	D	Te
12	*Calophyllum inophyllum* L.	Clusiaceae	E	4	73.1	0.16	M	R	M	S	
13	*Canthium dicoccum* (Gaertn.) Teijsm. & Binn.	Rubiaceae	E	10	38.64	0.4	NS	R	NA	S	
14	*Cassia fistula* L.	Caesalpiniaceae	D	4	34.6	0.32	NS	R	NA	S	Te,An
15	*Chionanthus zeylanica* L.	Oleaceae	E	10	40.9	0.26	NS	R	NA	S	Mi, An
16	*Cordia obliqua* Willd.	Cordiaceae	B	4	63.1	0.31	NS	R	NA	S	Te,An
17	*Crateva magna* (Lour.) DC.	Capparaceae	D	4	73.2	0.64	NS	S	NA	S	
18	*Diospyros ebenum* Koen	Ebenaceae	E	10	46.7	0.3	NS	R	NA	S	Te,An, Mi, Sp
19	*Diospyros ferrea* (Wild.) Bakh	Ebenaceae	E	4	47.6	0.24	NS	R	NA	S	Te
20	*Drypetes sepiaria* (Wight and Arn.) Pax and Hoffm.	Euphorbiaceae	E	4	102.8	0.44	NS	R	NA	E	Te, An, Mi, Wa, Be
21	*Ehretia pubescens* Benth	Boraginaceae	B	4	37.3	0.18	NS	R	NA	E	
22	*Eugenia bracteata* (Wild.) Roxb.	Moraceae	E	4	33.9	0.14	NS	R	NA	S	
23	*Ficus benghalensis* L.	Moraceae	B	4	149.9	0.29	M	R	M	E	
24	*Ficus hispida* L.f.	Moraceae	B	4	62	0.2	M	R	M	E	Te
25	*Ficus religiosa* L.	Moraceae	B	4	241.2	0.64	NS	R	NA	E	Sp
26	*Flacourtia indica* (Burm.f.) Merr.	Flacourtiaceae	B	4	23.6	0.17	NS	SR	NA	E	
27	*Garcinia spicata* (Wight & Arn.) J.D. Hook.	Clusiaceae	E	4	122.1	1.63	M	R	Y	S	Te, La,An,Be
28	*Glycosmis mauritiana* Yuich. Tanaka.	Rutaceae	E	4	19.2	0.05	NS	S	NA	E	
29	*Gmelina asiatica* L.	Verbenaceae	E	4	29.1	0.02	NS	S	NA	E	Mi, An
30	*Ixora pavetta* T. Anderson	Rubiaceae	E	4	49.4	0.46	NS	R	NA	S	Mi, An
31	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	D	4	47.9	0.35	M	R	NA	S	Sp
32	*Lepisanthes tetraphylla* (Vahl.) Radlk.	Sapindaceae	E	10	51.7	0.44	NS	R	NA	D	Te,An, La, Bt,Mi

Sl. no.	Plant species	Family	Plant type	Sampl e size	Mean girth (cm)	Mean bark thickness (cm)	Sap quantity	Texture	Sap colour	Fissure	Fauna
								R/SR/S	M/W/Y/N/R	D/Di/S/E	
33	*Mallotus philippensis* (Lam.) Muell.-Arg.	Euphorbiaceae	E	4	23.4	0.73	NS	R	NA	S	Te, An
34	*Mallotus rhamnifolius* Muell.-Arg.	Euphorbiaceae	E	4	17.1	0.44	NS	S	NA	E	
35	*Manilkara hexandra* (Roxb.) Dubard	Sapotaceae	B	4	86.1	0.2	NS	R	NA	D	
36	*Maytenus emarginata* (Wild.) Ding Hou.	Celastraceae	E	4	25.2	0.05	NS	S	NA	S	
37	*Memecylon umbellatum* Burm.f.	Melastomataceae	E	10	37.9	0.3	NS	SR	NA	S	Mi, An, Te
38	*Mimusops elengi* L.	Sapotaceae	E	4	55.3	0.61	S	R	M	D	Te,An
39	*Morinda coreia* Buch. -Ham.	Rubiaceae	E	6	45.7	0.39	NS	R	NA	D	Te, Sp
40	*Morinda pubescesns* Sm.	Rubiaceae	B	4	21.2	0.06	NS	SR	NA	E	Te
41	*Ochna obtusata* DC.	Ochnaceae	D	4	39.3	0.12	NS	SR	NA	E	Te, An
42	*Pamburus missionis* (Wight) Swingle	Rutaceae	E	4	77.8	0.56	NS	R	NA	Di	
43	*Pleiospermium alatum* (Wall. ex Wight. & Arn.) Swingle	Rutaceae	E	4	55.2	0.17	NS	R	NA	E	
44	*Pongamia pinnata* (L.) Pierre	Papilionaceae	B	4	63.4	0.24	NS	SR	NA	E	
45	*Premna latifolia Roxb.*	Verbenaceae	E	4	97.3	0.75	NS	S	NA	E	
46	*Pterospermum canescens* Roxb.	Sterculiaceae	B	10	42.5	0.29	S	R	R	D	Te,An,Mi
47	*Pterospermum xylocarpum* (Gaertn.) Sant. & Wagh.	Sterculiaceae	B	4	68.1	0.74	S	R	R	D	Te, An,
48	*Salvadora persica* L.	Salvadoraceae	B	4	67.4	0.15	NS	S	NA	S	
49	*Sapindus emarginatus* Vahl	Sapindaceae	B	4	89.2	0.29	NS	R	NA	D	Te,An, La, Mi
50	*Securenega leucopyrus* (Willd.) Muell.-Arg.	Euphorbiaceae	E	4	6	0.04	NS	S	NA	E	
51	*Semecarpus anacardium* L. f.	Anacardiaceae	D	4	112.5	0.25	M	SR	B	S	
52	*Streblus asper* Lour.	Moraceae	E	4	46	0.27	S	SR	M	S	
53	*Strychnos nux-vomica* L.	Loganiaceae	D	4	37.4	0.16	NS	R	NA	S	
54	*Syzygium cumini* (L.) Skeels	Myrtaceae	B	4	123.3	0.53	S	SR	NA	D	Mi, An
55	*Tamarindus indica* L.	Caesalpiniaceae	B	4	82.1	0.81	NS	R	NA	D	Te, Sp
56	*Tarenna asiatica (L)* kuntz ex Schumann.	Rubiaceae	E	4	12.3	0.07	NS	S	NA	E	
57	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae	D	4	114.2	0.23	NS	R	NA	D	Te, An, Mi
58	*Tricalysia sphaerocarpa* (Dalz.) Gamble	Rubiaceae	E	45	48.7	0.35	NS	S	NA	E	Te, An, Mi
59	*Vitex altissima* L.f.	Verbenaceae	D	4	74.1	0.13	NS	SR	NA	S	
60	*Walsura trifolia* (A. Juss.) Harms	Meliaceae	E	4	103.7	0.78	NS	R	NA	D	Te, An
	Lianas										
61	*Abrus precatorius* L.	Papilionaceae	B	4	5	0.06	NS	SR	NA	S	Te, Wa
62	*Acacia caesia* (L.) Willd.	Mimosaceae	B	10	14.3	0.21	NS	R	NA	E	Te, An, Mi
63	*Ampelocissus tomentosa* (Heyne ex Roth) Planch.	Vitaceae	B	2	5	0.1	NS	SR	NA	S	
64	*Argyreia cymosa* (Roxb.) Sweet	Convolvulaceae	E	4	5	0.13	S	SR	M	S	Sp

Sl. no.	Plant species	Family	Plant type	Sample size	Mean girth (cm)	Mean bark thickness (cm)	Sap quantity	Texture	Sap colour	Fissure	Fauna
								R/SR/S	M/W/Y/N/R	D/Di/S/E	
65	*Canavalia virosa* (Roxb.) Wight & Arn.	Papilionaceae	D	4	3.9	0.07	NS	SR	NA	E	Te
66	*Cansjera rheedii* Gmel.	Opiliaceae	E	4	14.3	0.17	NS	SR	NA	S	
67	*Capparis brevispina* DC.	Capparaceae	E	10	10.7	0.15	NS	R	NA	S	
68	*Capparis rotundifolia* Rottl.	Capparaceae	E	4	10.1	0.05	NS	S	NA	E	
69	*Capparis sepiaria* L.	Capparaceae	E	4	13.7	0.14	NS	R	NA	S	
70	*Capparis zeylanica* L.	Capparaceae	E	4	21.3	0.16	NS	R	NA	S	
71	*Carissa spinarum* L.	Apocynaceae	E	10	6.9	0.09	M	R	M	E	Sp
72	*Cayratia pedata* (Lam.) Juss. ex Gagnep.	Vitaceae	E	4	6.4	0.06	NS	S	NA	E	
73	*Cissampelos pareira* L. var. *hirsuta* (Buch.-Ham. ex DC.) Forman	Menispermaceae	B	4	3.4	0.06	M	SR	NA	E	
74	*Cissus quadrangularis* L.	Vitaceae	E	10	4.1	0.01	NS	SR	NA	E	
75	*Cissus vitiginea* L.	Vitaceae	D	10	10.1	0.29	NS	R	NA	E	
76	*Coccinia grandis* (L.) Voigt	Cucurbitaceae	E	10	9.3	0.16	NS	SR		E	
77	*Combretum albidum* G.Don	Combretaceae	D	10	8.2	0.53	NS	R	NA	S	Te, Sp
78	*Derris ovalifolia* (Wight & Arn.) Benth.	Papilionaceae	E	4	13.1	0.13	NS	S	NA	E	
79	*Dioscorea oppositifolia* L.	Dioscoreaceae	D	4	2	0.07	NS	S	NA	E	
80	*Grewia rhamnifolia* Heyne ex Roth	Tiliaceae	B	10	11.6	0.14	S	R	NA	D	Mi, An
81	*Gymnema sylvestre* (Retz.) R.Br. ex Schultes	Asclepiadaceae	E	10	6.6	0.22	M	R	Y	E	Sp
82	*Hugonia mystax* L.	Linaceae	E	10	7.7	0.09	NS	R	NA	S	
83	*Ichnocarpus frutescens* (L.) R.Br.	Apocynaceae	E	4	4.1	0.02	M	R	Y	E	Sp
84	*Jasminum angustifolium* (L.) Willd.	Oleaceae	E	4	7.2	0.13	NS	R	NA	S	Te
85	*Lantana camara* L.	Verbenaceae	E	4	7	0.04	NS	R	NA	E	
86	*Leptadenia reticulata* (Retz.)Wight & Arn	Asclepiadaceae	B	4	5	0.07	M	R	W	E	An
87	*Maerua oblongifolia* (Forsk.) A.Rich.	Capparaceae	E	4	4.3	0.06	NS	SR	NA	E	
88	*Mukia maderaspatana* (L.) M. Roem.	Cucurbitaceae	B	4	3.4	0.04	NS	SR	NA	E	
89	*Olax scandens* Roxb.	Olacaceae	E	4	16	0.14	NS	R	NA	E	
90	*Pachygone ovata* (Poir) Miers ex Hook.	Menispermaceae	E	10	7.4	0.07	NS	S	NA	E	Te, Sc
91	*Plecospermum spinosum* Trecul.	Moraceae	E	4	14.5	0.83	M	R	M	S	Sp
92	*Premna corymbosa* (Burm.f.) Rottl. & Willd.	Verbenaceae	E	10	5.3	0.06	NS	S	NA	E	
93	*Pyrenacantha volubilis* Wight	Icacinaceae	E	10	5.2	0.06	NS	SR	NA	E	
94	*Reissantia indica* (Willd.) Halle	Celastraceae	E	10	9.6	0.05	NS	SR	NA	E	
95	*Rivea hypocrateriformis* (Desr.) Choisy.	Convolvulaceae	E	4	12.2	0.1	M	S	M	E	Sp
96	*Salacia chinensis* L.	Hippocrtateaceae	E	4	14.1	0.23	NS	SR	NA	E	
97	*Strychnos lenticellata* Hill	Loganiaceae	E	10	5.9	0.05	NS	SR	NA	E	
98	*Tiliacora acuminata* (Lam.) Hook. f. & Thoms.	Menispermaceae	E	4	4.5	0.1	NS	SR	NA	E	An, Mi
99	*Tinospora cordifolia* (Willd.) Hook. f. &Thoms.	Menispermaceae	D	6	4.6	0.21	NS	R	NA	E	

Sl. no.	Plant species	Family	Plant type	Sample size	Mean girth (cm)	Mean bark thickness (cm)	Sap quantity	Texture	Sap colour	Fissure	Fauna
								R/SR/S	M/W/Y/N/R	D/Di/S/E	
100	*Toddalia asiatica* (L.) Lam.	Rutaceae	E	4	6	0.1	NS	S	NA	E	
101	*Toxocarpus kleinii* Wight & Arn.	Asclepiadaceae	E	4	3.1	0.04	S	SR	W	E	
102	*Tylophora indica* (Burm. f.) Merr.	Asclepiadaceae	D	4	3.7	0.1	S	S	W	E	An
103	*Ventilago madraspatana* Gaertn.	Rhamnaceae	E	4	37.1	0.48	NS	R	NA	S	
104	*Wattakaka volubilis* T. Cooke	Asclepiadaceae	E	4	15.4	0.26	S	SR	W	E	
105	*Ziziphus oenoplia* (L.)Mill.	Rhamnaceae	B	9	9.4	0.18	NS	SR	NA	E	

How to cite this article:

Anil, K., Parthasarathy, N., 2016. Bark traits of woody species and bark resource use by faunal community in tropical dry evergreen forest of India. Int. J. Curr. Res. Biosci. Plant Biol. 3(2), 77-90. doi: http://dx.doi.org/10.20546/ijcrbp.2016.302.010