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Host plants of the home invading nuisance pest, Mupli beetle, *Luprops tristis* (Fabricius, 1801) (Coleoptera: Tenebrionidae) in agribelts of south India

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ABSTRACT: Presence of home invading nuisance pest *Luprops tristis* (Fabricius, 1801) in non-rubber belts and its generalist feeding behavior lead to assessment of its feeding preference on the leaves of common litter contributing plants in agribelts in south India. Bioassays with leaves of 17 plants namely, cashew, cassia, cocoa, flowering murdah golden flame tree, Indian-beech, Indian kino, jackfruit, macaranga, mahogany, mango, mexican lilac, raintree, rubber, tamarind, teak and wild jack were carried out. General bias towards tender leaves of most plants was distinct. Based on Leaf age related variation in feeding rates, host plant were categorised as tender leaf preferred, both tender and senescent leaves preferred and senescent leaf preferred. Based on leaf consumption rates, host plants were broadly categorized as most preferred, moderately preferred, low preferred and least preferred, and its implications are discussed. Aggressive feeding on leaves of many plants abundant in non-rubber agriculture belts necessitates their monitoring in the litter stands of the cited plants in non-rubber belts for preventing its establishment as uncontrollable nuisance pest across south India. © 2020 Association for Advancement of MEntomology

KEY WORDS: rubber litter beetle, feeding preference, implications

INTRODUCTION

Massive home invasion of the litter dwelling darkling beetle, *Luprops tristis* (Fabricius, 1801), regionally referred to as "Mupli vandu", "Ola prani", "Ola chathan", "Otteruma" or "Karinchellu", following summer showers is a regular event in the rubber plantation belts of south India. High abundance in the range of 0.5 to over 4 million per residential building, active nocturnal movements, aggregation in a state of dormancy inside residential buildings extending upto 6-8 months and release of an odoriferous glandular secretion causing skin burn and eye inflammation makes *L. tristis,* a serious nuisance pest in rubber plantation belts. Litter stands of monoculture rubber plantations are the major breeding and feeding habitat of *L. tristis* in the region with wilted tender rubber leaves [*Hevea brasiliensis,* (Willd. ex Adr. De Jus) Müll. Arg. 1865] as the preferred food resource (Sabu et al. 2008). Availability of the nutritionally superior prematurely fallen tender leaves of rubber tree as food resource and perfect synchronism of its life cycle with the leaf phenology of rubber tree has lead to exceptionally high abundance of *L. tristis* in rubber plantation belts (Sabu and Vinod, 2009 a, b;

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Sabu *et al*., 2013). Fallen leaves of cocoa (*Theobroma cacao* Linnaeus, 1753) and jackfruit (*Artocarpus heterophyllus* Lamarck, 1789) are the major alternate food sources of *L. tristis* in rubber plantation belts (Sabu *et al*., 2012).

Presence of *L. tristis* infestation in non-rubber, non-jackfruit, and non-cocoa belts in many regions of south India (personal observations) and the dry eastern slope of the south Western Ghats (Sabu *et al*., 2007), home invasion in north Malabar region even before the introduction of rubber plantations (Beeson, 1941) and its generalist feeding nature (Sabu *et al*., 2012) indicate that *L. tristis* can sustain on the leaf litter of many other plants and is not confined to rubber belts alone. Considering its generalist and detritivorous feeding habits (Sabu *et al*., 2008), preference for tender leaves (Sabu and Vinod, 2009 b; Sabu *et al*., 2012) and presence in non-rubber belts, it is hypothesized that *L. tristis* can feed on both tender and senescent leaves of shade trees, plantation crops and trees maintained for fodder for domesticated mammals, green manure, and fruits in south India. Data generated would be helpful in identifying the host plants and breeding habitats of *L. tristis* in non-rubber regions where its host plants remain unknown and in controlling the spread of the beetle into new regions at the outset.

MATERIALS AND METHODS

Study was carried out during March–April 2013 at Department of Zoology, St. Joseph's College, Devagiri, Calicut, Kerala (India). To ensure uniformity of age at the beginning of the experiment, teneral adults of *L. tristis* were collected based on their brownish white body colour (Sabu et al. 2008) from the rubber plantation litter in the Devagiri College campus, located 6 km east from the Malabar Coast at Kozhikode (11°16'12.9"N 75°49'48.108"E), in the Kerala state of India. Collected beetles were reared in clay vessels (13 x 35 cm) placed in an environmental chamber (YORCO, India) at relative humidity 70% and temperature 33°C (representing the average temperature and humidity in the rubber plantation litter) and fed with a mixture of diced tender and senescent leaves of the 17 leaf types for 10 days to reduce the possible effect of leaf quality variations on growth rate and feeding preference. Beetles were deprived of food for 24 hrs before starting the feeding experiments. List of the plants analysed are cashew (*Anacardium occidentale,* Linn. 1753; Anacardiaceae, Sapindales), cassia (*Cassia fistula,* Linn. 1753; Fabaceae, Fabales), cocoa (*Theobroma cacao,* Linn. 1753; Malvaceae, Malvales), flowering murdah (*Terminalia paniculata* Roth. 1821; Fabaceae, Fabales), golden flame tree (*Peltophorum pterocarpum* (DC.) Baker ex K. Heyne 1927; Fabaceae, Fabales), Indian-beech (*Pongamia pinnata* (L.) Pierre 1899; Fabaceae, Fabales), Indian kino (*Pterocarpus marsupium* Roxb. 1795; Fabaceae, Fabales), jackfruit (*Artocarpus heterophyllus,* Lam. 1789; Moraceae, Rosales), macaranga (*Macaranga peltata* Müll.Arg. 1866; Euphorbiaceae, Malpighiales), mahogany (*Swietenia mahagoni* (L.) Jacq. 1760; Meliaceae, Sapindales), mango (*Mangifera indica,* Linn. 1753; Anacardiaceae, Sapindales), mexican lilac (*Gliricidia sepium* (Jacq.) Kunth 1842; Fabaceae, Fabales), raintree (*Albizia saman* (Jacq.)Merr. 1891; Fabaceae, Fabales), rubber [*Hevea brasiliensis* (Willd. ex Adr. De Jus) M¨ull. Arg. 1865; Euphorbiaceae, Malpighiales], tamarind (*Tamarindus indica* L. 1753; Fabaceae, Fabales) teak (*Tectona grandis* Linn. 1781; Verbinaceae, Lamiales) and wild jack (*Artocarpus hirsutus* Lam. 1789; Moraceae, Rosales). Tender and senescent leaves of the host plants were collected from non-rubber agriculture landscape at Chelavoor (11º30 N, 75º84 E) close to Calicut. Freshly sprouted leaves of five to ten days of age (identifiable by smaller size, smooth texture, and bright green or brown colour) were categorised as tender leaves and were collected from the tree branches of same height. Senescent leaves that are yellowish brown in colour were removed by a gentle flicking of the leaf from the trees. Collected leaves were brought to the laboratory and leaf discs (900 mm^2) of each leaf type were prepared and kept under ambient conditions for 24 h. For host plants like *P. pterocarpum* and *T. indica* where compound leaves with small leaflets are present, 18 small leaf discs (0.5cm^2) were used instead of a single leaf disc.

Experiment set up:

Food preferences were analysed with multiple choice and two choice leaf disc tests in the second week of March 2013 on successive days. Feeding preference towards tender and senescent leaves (two choice leaf disc tests: hereafter referred as no choice tests as it involves a single host plant) were carried out for 10 host plants namely, Flowering murdah (*Terminalia paniculata* Roth. 1821), Indian kino (*Pterocarpus marsupium* Roxb. 1795), Mahogany (*Swietenia mahagoni* (L.) Jacq. 1760), Macaranga (*Macaranga peltata* Müll.Arg. 1866), Golden flame tree (*Peltophorum pterocarpum* (DC.) Baker ex K. Heyne 1927), Mexican lilac (*Gliricidia sepium* (Jacq.) Kunth 1842), Indian-beech *(Pongamia pinnata* (L.) Pierre 1899), Raintree (*Albizia saman* (Jacq.)Merr. 1891), Teak (*Tectona Grandis* Linn. 1781) and Tamarind (*Tamarindus indica* Linn. 1753) and for seven host plants, namely Rubber [*Hevea brasiliensis,* (Willd. ex Adr. De Jus) M¨ull. Arg. 1865], Cashew (*Anacardium occidentale,* Linn. 1753), Mango (*Mangifera indica,* Linn. 1753), Jackfruit (*Artocarpus heterophyllus,* Lam. 1789), Wild jack (*Artocarpus hirsutus,* Lam. 1789), Cocoa (*Theobroma cacao,* Linn. 1753) and Cassia (*Cassia fistula,* Linn. 1753), data from the earlier study (Sabu et al. 2012) was used. Multiple choice leaf disc tests with tender and senescent leaf age classes were conducted for all the 17 host plants. Leaf discs (900 mm^2) of each leaf type were cut and were individually marked with stapler pins (one stapler pin on leaf type 1; 2 pins parallel to each other on leaf type 2; 2 pins crosswise on leaf type 3; 3 pins parallel to each other on leaf type 4, and so on) that enabled their identification. For no choice tests, one tender and one senescent leaf disc of each host plant was placed in a clay vessel (9 cm diameter × 5 cm height). For multi choice tests, one leaf disc of each host plant was loosely attached with a labelled pin to a thermocol sheet placed inside a clay vessel (15 cm diameter × 35 cm height) for both tender and senescent leaf age class separately. A distance of 5 mm between adjacent leaf discs was maintained. In no-choice experiments, three teneral beetles and in multiple-choice experiments nine teneral beetles were introduced into the centre of the vessel and allowed to feed for 24 h (8 am to 8 am). Based on the average food consumption of *L. tristis* (Sabu *et al*., 2012), introduction of three beetles for 17 host leaves would have resulted in satiation with a few host leaves and avoiding the others. Fifteen replicates were maintained for each host plant in no choice experiments and for each leaf age class in multi choice experiment. Leaf area consumed was estimated using a 1 mm^2 mesh size-reticulated paper glued on a glass slide. Amount of leaf disc consumed during the tests was estimated by subtracting the unconsumed area from the initial area of 900 mm^2 (Sabu *et al*., 2012).

Data Analysis:

Significance levels of variation in the quantity of leaf consumed among the leaf types and leaf ages were assessed with two-way ANOVA and pair wise differences among leaf types with Tukey-Kramer post hoc tests (*t* tests). Significance level of the variation in the quantity of leaf consumed between the tender and senescent leaves of each leaf type was assessed with one-way ANOVA. Based on the quantum of leaves consumed in multichoice experiments, tender and senescent leaves of host plants with leaf consumption of >10 mm were broadly classified as most preferred; 4 to 10 mm as moderately preferred; 1 to < 4 mm as low preferred; and <1 mm as least preferred host plant categories. Feeding recorded in no choice experiment was used to analyse the preference towards tender and senescent leaf age classes for each host plant and to measure the extent to which the beetle will feed on each host plant leaf when other leaf resources were not available as in monoculture plantations. Plants were ranked in no choice and multi choice experiments based on comparison of the variation in quantum of leaves consumed individually in both tender and senescent leaf age classes. The preference hierarchy was reached by ranking the leaf types based on the significance level of the pair wise treatments for each host plant. All analyses were done following square root transformation of the data (Weiss, 2007). Significance was determined at $P < 0.05$. Means that differ significantly ($P \leq 0.05$) within tender and senescent leaf age classes are indicated as differences in letters ([a-h]) attached to Mean±SD values. All statistical analyses were performed by using Minitab 16 Academic Software for windows (Minitab, 2010).

RESULTS

Quantity of leaf consumed by *L. tristis* varied among the different leaf types and leaf age classes in both no choice and multichoice experiments (Table 1, 2, and 3).

Tender-Senescent leaf preference: Analysis of feeding preference towards tender and senescent leaves of host plants revealed that tender leaves were preferred over senescent leaves for *P. marsupium*, *S. mahagoni*, *T. indica*, *P. pinnata*, *P. pterocarpum*, *H. brasiliensis*, *A. heterophyllus*, *A. occidentale*, *M. indica*, *A. hirsutus,* and *C. fistula*; senescent leaves were preferred over tender leaves for *G. sepium* and *T. grandis* and; both tender and senescent leaves were equally preferred for *M. peltata*, *A. saman*, *T. paniculata* and *T. cacao*. Comparison of tender leaf consumption in no choice tests showed that, tender leaves of *H. brasiliensis, A. heterophyllus,* and *T. cacao* were most preferred and tender leaves of *P. pterocarpum*, *T. grandis*, *S. mahagoni*, and *M. peltata* were the least preferred. Comparison of senescent leaf consumption in no choice tests revealed that senescent leaves of *H. brasiliensis* and *G. sepium* were the most preferred and senescent leaves of *T. indica*, *S. mahagoni,* and *P. pterocarpum* were the least preferred (Table 1).

Table 1. Quantity of tender and senescent leaves consumed (Mean±SD) by *Luprops tristis* in no choice experiments and ranking of host plants based on leaf consumption

Host plants	Tender leaves		Senescent leaves	
	Mean±SD	Rank	Mean±SD	Rank
*Hevea brasiliensis**	103.03±85.41[a]	1	48.40±41.10[a]	1
*Artocarpus heterophyllus**	125.33±83.61[a]	1	7.37±7.46[bc]	3
Theobroma cacao	76.93±56.68[a]	1	4.13±5.28[cde]	5
*Pongamia pinnata**	21.87±3.46[b]	2	1.15±1.03[efg]	8
Tamarindus indica *	15.20±6.66[bc]	3	0.20±0.22[g]	10
*Gliricidia sepium**	14.55±8.53[bcd]	4	26.70±14.07[a]	1
Pterocarpus marsupium *	13.43±6.99[bcd]	4	7.55±2.38[b]	2
Artocarpus hirsutus *	13.13±8.80[bcd]	4	1.30±0.93[defg]	7
*Anacardium occidentale**	9.60±7.84[cde]	5	2.37±3.81[defg]	7
Terminalia paniculata	5.65±2.77[def]	6	6.05±6.37[bc]	3
*Mangifera indica**	3.93±4.92[efg]	7	1.77±2.07[defg]	7
*Cassia fistula**	6.37±10.84[efg]	7	4.25±3.92[fg]	9
Albizia saman	3.20±5.45[fg]	8	0.92±1.45[bcd]	4
*Swietenia mahagoni**	1.46±1.21[fg]	8	0.20±0.19[g]	10
*Peltophorum pterocarpum**	1.15±0.63[fg]	8	0.28±0.27[fg]	9
Macaranga peltata	1.20±1.47[fg]	8	1.70±1.46[def]	6
Tectona grandis *	0.35±0.52[g]	9	3.20±1.96[cde]	5

Note: * indicate significant difference ($P \leq 0.05$) between tender and senescent leaves.

Difference in letters ([a-g]) attached to Mean±SD values indicates means that differ significantly ($P \leq 0.05$) within tender and senescent leaf age class category.

Table 2. Two-way ANOVA for feeding preference of *L. tristis* with respect to the leaf type and leaf age in no-choice and multiple-choice experiment tests

No choice					
Source	*SS*	*df*	*MS*	*F*	*p-value*
Leaf type	1,906.81	16	119.18	41.55	0
Leaf age	375.08	1	375.08	130.78	0
Leaf type × Leaf age	799.19	16	49.95	17.42	0
Error	1,365.24	476	2.87		
Multichoice					
Source	*SS*	*df*	*MS*	*F*	*p-value*
Leaf type	354.85	16	22.18	25.09	0
Leaf age	3.50	1	3.50	3.96	0
Leaf type × Leaf age	77.19	16	4.82	5.46	0
Error	270.54	306	0.88		

Table 3. Quantity of tender leaves consumed (Mean±SD) by *Luprops tristis* in multi choice experiments and categorisation and ranking of host plants based on tender leaf consumption

Host plant category	Host plants	Mean±SD	Rank
Most preferred (mean value ≥10 mm)	*Artocarpus heterophyllus*	15.33±4.95[a]	1
	Hevea brasiliensis	22.20±8.66[a]	1
Moderately preferred (mean value 4 ≥ 10 mm)	*Theobroma cacao*	6.93±5.46[b]	2
	Pongamia pinnata	9.48±9.36[b]	2
	Pterocarpus marsupium	8.88±2.43[b]	2
	Gliricidia sepium	5.75±4.84[bc]	3
Low preferred (mean value 1≥ 4 mm)	*Tamarindus indica*	3.30±3.11[cd]	4
	Anacardium occidentale	2.95±3.07[cde]	5
	Cassia fistula	3.25±3.74[cde]	5
	Mangifera indica	2.83±3.08[cde]	5
	Artocarpus hirsutus	2.80±2.82[cde]	5
	Terminalia paniculata	1.58±2.01[def]	6
	Albizia saman	1.50±1.74[def]	6
Least preferred (mean value > 1 mm)	*Peltophorum pterocarpum*	0.73±0.97[ef]	7
	Swietenia mahagoni	0.33±0.55[f]	8
	Tectona grandis	0.05±0.11[f]	8
	Macaranga peltata	0.33±0.46[f]	8

Note: Difference in letters ([a-f]) attached to Mean±SD values indicates means that differ significantly ($P > 0.05$)

Host plant preference and categorisation of host plants:

Based on tender leaf preference: Based on the analysis of tender leaf consumption, *H. brasiliensis* and *A. heterophyllus* fall under the category of the most preferred tender leaves; *T. cacao*, *P. pinnata*, *G. sepium,* and *P. marsupium* fall under the category of moderately preferred tender leaves; *A. occidentale*, *A. hirsutus*, *C. fistula*, *T. indica*, *M. indica*, *T. paniculata,* and *A. saman* fall under the category of low preferred tender leaves and *P. pterocarpum*, *T. grandis*, *S. mahagoni,* and *M. peltata*, fall under the category of the least preferred tender leaves. Based on the quantum of tender leaves consumed *H. brasiliensis* and *A. heterophyllus* were ranked first, *T. cacao*, *P. pinnata*, were ranked second and *G. sepium* third in preference hierarchy (Table 3).

Based on senescent leaf preference: *Hevea brasiliensis* and *G. sepium* fall under the category of most preferred senescent leaves; *T. paniculata*, *P. marsupium,* and *A. heterophyllus* under the category of moderately preferred senescent leaves; *T. cacao*, *T. grandis*, *A. hirsutus*, *M. indica*, and *A. saman* under the category of low preferred senescent leaves and *P. pinnata*, *P. pterocarpum*, *A. occidentale*, *C. fistula*, *S. mahagoni*, *M. peltata*, and *T. indica* under the category of least preferred senescent leaves. Based on the quantum of senescent leaves consumed *H. brasiliensis* and *G. sepium* were ranked first, *A. heterophyllus* second and *P. marsupium* third in preference hierarchy (Table 4).

DISCUSSION

Tender-senescent leaf preference of host plants:

Based on tender-senescent leaf preference of *L. tristis*, host plants fall under three broad categories namely: 1) plants whose tender leaves are preferred, 2) plants whose senescent leaves are preferred, and 3) plants whose tender and senescent leaves are equally preferred. Lack of quantitative data on the leaf chemical traits of tender and senescent leaves of the native trees limits the scope for interpretation. Preference towards tender leaves of 10 host plants in the agribelts namely, *H. brasiliensis, A. heterophyllus*, *P. pinnata*, *P. marsupium*, *A. hirsutus*, *M. indica*, *T. indica*, *P. pterocarpum*, *A. occidentale*, and *C. fistula*, in both no choice and multichoice experiments conforms to the record of the preference of *L. tristis* towards tender leaves (Sabu *et al*., 2012; Sabu and Vinod, 2009 b). Since host plant quality is a key determinant of potential and achieved fecundity of herbivorous insects (Awmack and Leather, 2002), tender leaves of *H. brasiliensis* are essential for attaining reproductive maturity, egg production, longevity, and storage of fat reserves for the impending prolonged dormancy of *L. tristis* (Sabu *et al*., 2013; Vinod and Sabu, 2010); preference of *L. tristis* towards tender leaves is attributed to the high nutrient status of tender leaves of the host plants. Translocation of mobile nutrients from senescing leaves to new tissue by nutrient resorption which occurs at higher rates in deciduous trees and lower rates in evergreen trees makes tender leaves superior in nutrient quality over their senescent leaves (Aerts, 1996; Wright and Westoby, 2003, Vergutz *et al.,* 2012). In addition, considering the role of leaf toughness and waxiness in determining the feeding preference of herbivorous insects (Howe and Schaller, 2008; Xiang and Chen, 2004), preference towards the soft and non-glossy tender leaves over the hard, glossy senescent leaves might have contributed to the greater feeding on tender leaves.

In spite of the low nutrient quality of senescent leaves of deciduous trees (Aerts, 1996; Newbery *et al*., 1997; Wright and Westoby, 2003; Vergutz *et al.,* 2012), preference towards senescent leaves of deciduous *G. sepium* and *T. grandis* over their tender leaves indicates that some factor other than leaf nutrient quality repel *L. tristis* from feeding on their tender leaves. High nitrogen (N) content in senescent leaves resulting from the reduced nutrient resorption rates in N fixing plants (Eckstein *et al*., 1999; Norris and Reich, 2009; Vergutz *et al*., 2012) might be leading to higher feeding of *L. tristis* on senescent leaves of *G. sepium*. Preference of *L. tristis* towards senescent *T. grandis* leaves is in contrast to the preference of most insect pests to

Table 4. Quantity of tender and senscent leaves consumed (Mean±SD) by *Luprops tristis* in multi choice experiments and categorisation and ranking of host plants based on leaf consumption

Host plant/ Leaf category	Tender leaves			Sensecent leaves		
	Host plants	Mean±SD	Rank	Host plants	Mean±SD	Rank
Most preferred (mean value >10 mm)	*Artocarpus heterophyllus*	15.33±4.95^{a}	1	*Hevea brasiliensis*	22.20±8.66^{a}	1
	Hevea brasiliensis	12.90±4.74^{a}	1	*Gliricidia sepium*	15.18±7.94^{a}	1
Moderately preferred (mean value 4 ≥ 10 mm)	*Theobroma cacao*	6.93±5.46^{b}	2	*Artocarpus heterophyllus*	6.78±5.28^{b}	2
	Pongamia pinnata	9.48±9.36^{b}	2	*Pterocarpus marsupium*	6.13±6.49^{bc}	3
	Pterocarpus marsupium	8.88±2.43^{b}	2	*Terminalia paniculata*	5.25±6.11^{bd}	4
	Gliricidia sepium	5.75±4.84^{bc}	3	*Theobroma cacao*	3.43±3.75^{cde}	5
Low preferred (mean value 1 ≥ 4 mm)	*Tamarindus indica*	3.30±3.11^{cd}	4	*Atrocarpus hirsutus*	1.48±1.20^{def}	6
	Anacardium occidentale	2.95±3.07^{cde}	5	*Albizia saman*	2.90±4.06^{def}	6
	Cassia fistula	3.25±3.74^{cde}	5	*Tectona grandis*	1.45±1.40^{ef}	7
	Mangifera indica	2.83±3.08^{cde}	5	*Mangifera indica*	1.15±1.74^{fg}	8
	Artocarpus hirsutus	2.80±2.82^{cde}	5	*Anacardium occidentale*	0.45±0.44^{fg}	8
	Terminalia paniculata	1.58±2.01^{def}	6	*Cassia fistula*	0.56±0.75^{fg}	8
	Albizia saman	1.50±1.74^{def}	6	*Macaranga peltata*	0.23±0.40^{g}	9
Least preferred (mean value > 1 mm)	*Peltophorum pterocarpum*	0.73±0.97^{ef}	7	*Swietenia mahagoni*	0.03±0.08^{h}	10
	Swietenia mahagoni	0.33±0.55^{f}	8	*Pongamia pinnata*	0.13±0.27^{h}	10
	Tectona grandis	0.05±0.11^{f}	8	*Tamarindus indica*	0.10±0.17^{h}	10
	Macaranga peltata	0.33±0.46^{f}	8	*Peltophorum pterocarpum*	0.08±0.12^{h}	10

(Note : Difference in letters ($^{a-h}$) attached to Mean±SD values indicates means that differ significantly ($P \geq 0.05$) within tender and mature leaf age class category*)*

tender *T. grandis* leaves during the leaf flushing period (Basu *et al*., 2010). Hence what attracts *L. tristis* to senescent leaves of *T. grandis* requires special attention.

Equal preference of *L. tristis* towards tender and senescent leaves of *T. cacao*, *T. paniculata*, *A. saman,* and *M. peltata,* indicate that *L. tristis* can feed on both the leaves of these host plants. Low nutrient resorption rates from the senescent leaves in evergreen trees (Aerts, 1996; Wright and Westoby, 2003; Vergutz *et al*., 2012) that lead to lack of nutrient quality variation between tender and senescent leaves and the presence of some plant species specific secondary metabolites in the tender leaves (Howe and Schaller, 2008) could be the reason for equal preference towards tender and senescent leaves of the evergreen trees namely, *T. cacao*, *A. saman,* and *M. peltata*. Presence of strigillose hairs in the surface of *T. paniculata* leaves in its expanding phase which protect the leaves from herbivore damage (Palaniswamy and Bodnaryk, 1994; Kallarackal and Chandrasekhara 2007), and the probable presence of some anti feedants in the tender leaves about which data is non existing might be the factors limiting the feeding on tender leaves of *T. paniculata* leading to equal preference on its tender and senescent leaves.

Ranking and categorisation of host plants based on feeding preference:

Analysis of the feeding preference towards the leaves of common plants revealed that *H. brasiliensis* is the most preferred host plant for *L. tristis* in both tender and senescent leaf category. High leaf nutrient levels in tender leaves resulting from nutrient resorption in deciduous trees (Aerts, 1996; Wright and Westoby, 2003; Vergutz *et al*., 2012) and the high nutrient levels in both tender and senescent leaves arising from regular fertiliser treatment in rubber plantations (Sabu *et al*., 2013) are the reasons for high preference towards tender and senescent leaves of deciduous *H. brasiliensis*.

Equal preference for tender *A. heterophyllus* leaves in level with tender *H. brasiliensis* leaves and selection of its senescent leaves as the preferred leaf resource after senescent *H. brasiliensis* leaves indicates that *A. heterophyllus* is the next most important host plant for *L. tristis* after *H. brasiliensis* and its leaves would be as nutrient rich as that of *H. brasiliensis*. Since *A. heterophyllus* is a common tree in rubber and non-rubber agribelts, availability of nutrients from annual fertiliser treatment in agribelts and the nutrients available from the decomposition of its fallen fruits and seeds could be making its leaves nutrient rich.

Theobroma cacao, *P. pinnata*, *P. marsupium* and *G. sepium* are the moderately preferred host plants of *L. tristis* after the most preferred *H. brasiliensis* and *A. heterophyllus*. However, since *L. tristis* is a litter dwelling detritivorous beetle that feed and breed in litter, availability of fallen leaves to the starved post-dormancy beetles is an important factor in determining the host plant potential. As senescent leaves of the deciduous *P. pinnata* are least preferred by *L. tristis* and there is no record of premature leaf fall of *P. pinnata* that makes its tender leaves available to *L. tristis* in field conditions, *P. pinnata* is not considered as a potential host plant of the beetle. Similar to *P. pinnata*, lack of tender leaf fall in *P. marsupium* restricts its ability to support *L. tristis* in field conditions. However, moderate feeding on its senescent leaves and its status as a dominant tree in the deciduous forests of south India (Sundarapandian *et al*., 2005; Nanda *et al.,* 2011) and as a shade tree in the agribelts in the eastern slopes of the south Western Ghats considered as the source region of *L. tristis* (Sabu *et al.,* 2007) points to the possibility of senescent *P. marsupium* leaves being an important food for *L. tristis* in these regions. Among the various host plants, *T. cacao* is a major plantation crop in rubber and non-rubber belts, and *G. sepium* is the most common hedge plant in agribelts as its leaves are utilisable as fodder and green manure and its ability for fast growth. Periodical pruning of mature and tender shoots of *T. cacao* and pruning and application of mature leaves of *G. sepium* as green manure by the farmers (Sabu *et al*., 2012; Kwesiga *et al,*. 2003; Bah and Rahman, 2001) makes tender and senescent leaves of *T. cacao* and senescent leaves of *G. sepium* available to *L. tristis* in agribelts in addition to the regular leaf shedding in evergreen *T. cacao* and annual leaf fall in deciduous *G. sepium*. Regular fertilizer addition in *T. cacao* plantations that makes its leaves nutrient rich and makes *T. cacao* an important alternate host plant of *L. tristis* in rubber belts and a potential host plant in non rubber belts. Preference towards senescent leaves of *G. sepium* in level with senescent *H. brasiliensis* leaves, moderate feeding on its tender leaves after *H. brasiliensis*, *A. heterophyllus*, *T. cacao,* and *P. pinnata* and its prevalence in both rubber and non rubber belts makes *G. sepium* an important host plant of *L. tristis* in the region. Lower nutrient resorption from senescent leaves in N fixing plants that makes its senescent leaves nutrient rich (Killengback, 1993; Eckstein *et al*., 1999; Norris and Reich, 2009; Vergutz *et al*., 2012) could be the reason for high preference of *L. tristis* towards senescent leaves of *G. sepium*. Prolonged availability of senescent leaves of *G. sepium* from January to May, the period of deciduous leaf fall in *G. sepium* trees (Simons and Stewart, 1994), which is in perfect synchrony with active life stages of *L. tristis* (Sabu *et al*., 2008) altogether indicates that the less noticeable but common *G. sepium* to be an important host plant of *L. tristis* after *H. brasiliensis* in both rubber and non rubber belts.

Among the seven low preferred host plants, equal preference towards senescent and tender leaves of *T. paniculata* and *A. saman* and their distributional pattern makes them more important host plants than the other five host plants for the following reasons. *Terminalia paniculata* is a common shade tree retained for green manure in the agribelts in the moist south Western Ghats and is a dominant tree in the natural forests of the Western Ghats (Sundarapandian *et al*., 2005; Nanda *et al*., 2011). Annual leaf fall of *T. paniculata* during pre-summer and widespread use of its senescent and tender leaves as green manure during summer lead to availability of its litter as food resource and breeding habitat for *L. tristis*. *Albizia saman* is another common evergreen tree across south India and is a shade tree in the campuses of many institutions and its fallen senescent leaves are available during all seasons. Though *T. indica* and *C. fistula* are common trees in south India and *A. hirsutus* common in rubber belts, low feeding on their senescent leaves and non availability of tender leaves by premature leaf fall makes them less important host plants of *L. tristis*. Despite the fact that with low consumption rates and preference towards tender leaves, the following aspects makes *M. indica* and *A. occidentale* as host plants of significance in south India. Wider presence of *M. indica* orchards in south India, its selections as a common shade tree in residential belts, occurrence of multiple leaf flushing (Bally, 2010) and the tender leaf fall due to wind action and leaf disease (personal observations) ensures regular availability of its tender leaves to *L. tristis* in rubber and non-rubber belts. Similarly preference towards tender *A. occidentale* leaves and presence of *A. occidentale* plantations with occasional premature leaf fall due to powdery mildew disease and defoliation by the caterpillar, *Nudaurelia bellina* (Orwa *et al*., 2009 d) leads to tender leaf availability to *L. tristis.*

Peltophorum pterocarpum, *S. mahagoni*, *M. peltate,* and *T. grandis* are the least preferred host plants. Low N and high phenol content of *S. mahagoni* and *T. grandis* leaves which provides resistance from insect herbivory (Basu *et al*., 2010) along with leaf toughness of *T. grandis* and leaf toughness and waxiness of *S. mahagoni* leaves could be the reasons for low feeding on these two plants. Low preference towards *S. mahagoni* and *T. grandis* indicates that litter stands of *S. mahagoni* or *T. grandis* monoculture plantations would not be selected by *L. tristis* as its breeding sites. Leaf toughness and waxiness of *P. pterocarpum* and leaf toughness of *M. peltata* could be the reason for low feeding on these plants and data on the chemical traits of these two plants are non existent. Low preference towards *P. pterocarpum* which is a common shade tree in the premises of most old buildings and *M. peltata*, a common shade tree, in the agriculture belts indicate that these two trees would not aid in the population build up of *L. tristis* in any region.

Major host plants of *L. tristis* are *H. brasiliensis*, *A. heterophyllus*, *T. cacao*, and *G. sepium* in moist regions and *P. marsupium*, *P. pinnata*, *T. indica*, *M. indica*, and *T. paniculata* in dry regions of south India. General bias towards tender leaves of most host plants is distinct. Host plants fall under three heads: tender leaf preferred, senescent leaf preferred, and both tender and senescent leaf preferred. *L. tristis* is a generalist feeder of most plants and hence scarcity of a few host plants may not regulate its population build up and possibility of its spread to non rubber belts is high. High preference of *L. tristis* towards senescent leaves of *G. sepium* and its easy availability makes *G. sepium* an important host plant of *L. tristis* in rubber and non rubber belts. Abundance of *L. tristis* in regions where less preferred host plants like *T. paniculata*, *M. indica,* and *A. occidentale* are abundant points towards the possibility of low ranked host plants supporting *L. tristis*. This necessitates data on the reproductive performance of *L. tristis* on both high and low preferred host plants to reach at conclusion. Lack of data on leaf chemical quality of the native plants makes even preliminary interpretation of leaf age class and host plant related variations in the feeding preference of *L. tristis* impossible.

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