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Research Article

**INVASION OF EXOTIC MEDICINAL WEEDS LANTANA SP.
AND EUPATORIUM SP. AND ITS IMPACTS ON THE AVIAN
DIVERSITY IN THE MUDUMALAI WILDLIFE SANCTUARY,
INDIA**

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Abstract:

Distribution of invasive exotic medicinal weeds, Lantana sp. and Eupatorium sp. in different parts of Mudumalai Wildlife Sanctuary, India has been documented. Weed intensity was found to increase the avian diversity. The bird species richness was also more in high weed intensity areas Lantana sp. is a major food plant for various frugivorous birds and omnivorous birds. These exotic plants especially Lantana sp. also helps the birds to breed and hide. The common peafowl was previously (before more weed invasion) distributed in very less numbers in Mudumalai but now the population is very high. In low weed areas the common peafowl distribution is very less than the high weed intensity areas of the sanctuary.

Key words: Avian diversity, Eupatorium, Exotics, Invasion, Lantana and Mudumalai

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INTRODUCTION:

Weed proliferation causes a serious concern for wildlife management. Degradation of habitat coupled with the appearance of unpalatable plant species is mainly due to the invasion of a few exotic weeds namely *Eupatorium* sp. and *Lantana* sp. It is true that successional habitats attract more species in the eco-system [1]. In such habitat the plant association changes with the invasion of weeds. Suppression of native plant species and loss of food resources to herbivores are the major consequences of weed proliferation. This has led to serious threat to local fauna and flora. For instance, invasion of weed would arrest the integrity of habitats and thereby lower its quality to hold diverse assemblage of animals. The gross changes in the structure and composition of vegetation, both immediately following invasions of weed and in the long run, would bring about complementary changes in the fauna. Though authorities cautioned its serious impact to the ecosystem, field studies on the impact of weeds have been less attended in India.

Lantana camara is considered to be a weed in large areas of the Paleotropics where it has established itself. It can become the dominant under storey shrub, crowding out other native species and reducing biodiversity, in agricultural areas or secondary forests [2]. The formation of dense thickets of *L. camara* can significantly slow down the regeneration of forests by preventing the growth of new trees. *L. camara* is considered invasive to the Western Ghats, Studies have found that *Lantana* leaves can display antimicrobial, fungicidal and insecticidal properties [3] *L. camara* has also been used in traditional herbal medicines for treating a variety of ailments, including cancer, skin itches, leprosy, rabies, chicken pox, measles, asthma and ulcers. Likewise, another weed viz., *Eupatorium* sp. is also considered to be a threat to the forest ecosystems. However, it is also used in the treatment of dengue fevers [4], colds, kidney and liver complaints, rheumatism etc. *Eupatorium perfoliatum* has also been used to relax peripheral blood vessels, promote bile flow, as an anti-spasmodic by relaxing smooth muscles, a laxative,

and an expectorant [5]. Another important and widely accepted uses of *Eupatorium* is as an immune-stimulant [4]. Other uses are as an immuno-stimulant, pain reliever, fever reducer, and a mucous membrane tonic [4].

Birds are an important forest resource because of their ecological role and recreational value [6]. An important aspect of the ecology of birds pertains to factors that influence their number and richness i.e., their diversity. Diversity, an old and popular concept in ecology [7] was the most highly valued criterion used for the assessment of conservation potential and ecological value [8,9,10,11 & 12]. It is a major aim of conservation [13] and was also frequently used to judge the success of conservation efforts [14].

Avian population densities and diversity can be influenced by the singular or interactive influence of a variety of factors such as habitat physiognomy, habitat availability, predation, intra-specific and inter-specific resource competition, parasites and diseases, and weather [15,16,17,18,19 & 20]. The magnitude of the influence of these factors may vary in importance according to geographical area, food habits and migratory status of the birds [15,21,22, & 23].

This paper documents the effects of the above mentioned weed species density and distribution on bird diversity and abundance in the Mudumalai Wildlife Sanctuary, India

STUDY AREA

The Mudumalai Wildlife Sanctuary (Fig.1) is an offshoot of the Nilgiri Biosphere Reserve (NBR) of the Western Ghats. This sanctuary lies between latitudes 11° 32' and 11° 42' North and longitudes 76° 20' and 76° 40' East and situated at the confluence of three southern states viz., Tamil Nadu, Kerala and Karnataka. Bandipur Tiger Reserve in the north, Sigur Reserved forest in the east and Wyanad Wildlife Sanctuary in the west encompasses the sanctuary. The extent of this sanctuary is 321 sq. km.

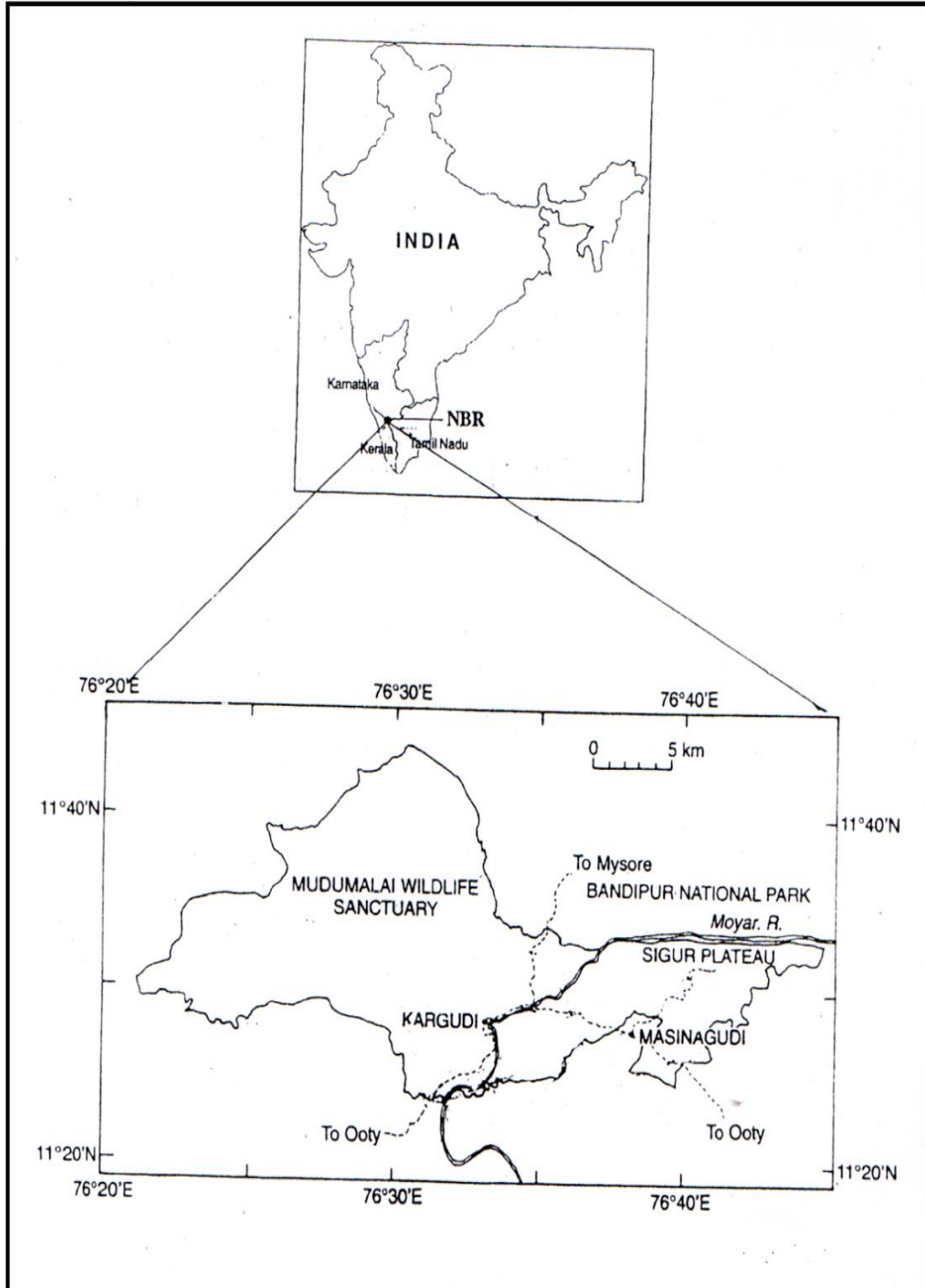


Fig. 1: Location map of Mudumalai wildlife sanctuary

MATERIAL AND METHODS:**Study period**

The present study was carried out in Mudumalai Wildlife Sanctuary of Nilgiri Biosphere Reserve from January 2000 to December 2001.

Exotic weed plant survey

Surveys were carried out in the study area to assess the distribution pattern of weed patches. The entire area of the sanctuary was surveyed on foot and weed invasion (species wise) was recorded on respective habitats. For this study two dominant exotic weed species viz., *Eupatorium* and *Lantana* were selected. Among the game roads and animal trails at every 100 meter interval, 20 m X 5 m quadrates were laid and the percentage of occurrences of exotic plants were recorded to find out the extent of weed invasion in the different compartments.

Avian surveys

Birds were identified by using the pictorial field guide [24]. Bird surveys were done by following the line transect method [25]. A total of 10 transects were laid viz., two transects in scrub jungle habitat, three in dry deciduous habitat, two in moist deciduous habitat, one in ecotone between dry deciduous and moist deciduous habitat, one in ecotone between dry deciduous and scrub jungle and one in riverine habitat for bird surveys. The number of transects laid were based on the relative extents of the habitats. Length of transects ranged between 1.5 km and 2.5 km according to the habitat size. All transects run through various microhabitats in a specified habitat to get representative census data. Bird surveys were conducted in each transect on foot during morning hours between 6.00 am and 10.00 am. The surveys were two times a month in moist deciduous habitat and scrub jungle (where two transects were laid) once a month in the dry deciduous forest (where three transects were laid) and one in a month in other habitat (where one transect was laid).

OBSERVATION AND RESULTS:**Bird species composition of different habitats of Mudumalai wildlife sanctuary**

A total number of 169 species of birds belonging to 13 orders cover second in different habitats of Mudumalai wildlife sanctuary during the study period. The scrub jungle had the highest number of species (115) followed by dry deciduous forest (103) Moist deciduous forest (99) Ecotone between dry deciduous and moist deciduous forests (93) riverine forest (88) and the ecotone between dry deciduous forest and scrub jungle (84). Among these 138 species were recorded from weed infested areas.

Avian use of weed infested areas

Distribution of birds in different weed intensity areas of Mudumalai wildlife sanctuary has been given in table 1 and the avian characteristics of different habitats with different weed intensities in table 2.

Both the number of bird species and the total number of bird species showed an increase in with increase in weed intensities in all habitats. The avian diversity values were also higher in higher weed intensity areas.

The number of bird species recorded was lowest in the dry deciduous forest with sparse weed distribution (61) and highest in the moist deciduous forest with very high weed intensity (107) and scrub jungle with medium weed intensity (117). The total number of birds observed was lowest (384) in the dry deciduous area with sparse weed intensity and highest (2895) in the scrub jungle with medium weed intensity.

The red spur fowl, red turtle dove, singing bush lark, yellow throated sparrow, baya weaver bird and black headed munia were observed only in the scrub jungle with medium weed intensity.

Table 1: Distribution of birds in different weed intensity areas of Mudumalai wildlife sanctuary

S#	Common Name	Scientific Name	DDS	DDH	DDVH	MDH	MDVH	SJL	SJM
1	Brahminy kite	<i>Haliastur indus</i>					*		
2	Eurasian sparrowhawk	<i>Accipiter badius</i>						*	*
3	Changeable hawk eagle	<i>Spizaetus cirrhatus</i>	*	*	*	*	*		*
4	Bonellis eagle	<i>Hieraetus fasciatus</i>		*		*			
5	Indian white backed vulture	<i>Gyps bengalensis</i>			*	*			
6	Crested serpent eagle	<i>Spilornis cheela</i>		*			*	*	*
7	Grey francolin	<i>Francolinus pondicherianus</i>		*				*	*
8	Red spur fowl	<i>Galloperdix spadicea</i>							*
9	Grey jungle fowl	<i>Gallus sonneratti</i>	*	*	*	*	*	*	*
10	Indian peafowl	<i>Pavo cristatus</i>		*	*	*	*	*	*
11	Red wattled lapwing	<i>Vanellus indicus</i>					*	*	*
12	Yellow legged green pigeon	<i>Treron phoenicoptera</i>			*	*	*		*
13	Nilgiri wood pigeon	<i>Columba elphinstoni</i>					*	*	*
14	Eurasian collard dove	<i>Streptopelia decaocto</i>							*
15	Oriental turtle dove	<i>Streptopelia orientalis</i>	*	*	*	*	*	*	*
16	Spotted dove	<i>Streptopelia chinensis</i>					*	*	*
17	Emerald dove	<i>Chalcophaps indica</i>						*	*
18	Alexandrine parakeet	<i>Psittacula eupatria</i>		*	*		*	*	*
19	Rose ringed parakeet	<i>Psittacula krameri</i>	*	*	*	*	*	*	*
20	Blosm headed parakeet	<i>Psittacula roseate</i>	*	*	*	*	*	*	*
21	Blue winged parakeet	<i>Psittacula columboides</i>		*	*		*	*	*
22	Indian hanging parrot	<i>Loriculus vernalis</i>		*				*	
23	Pied crested cuckoo	<i>Clamator jacobinus</i>		*				*	
24	Brainfever bird	<i>Hierococcyx varius</i>	*	*	*		*	*	*
25	Indian cuckoo	<i>Cuculus micropterus</i>				*	*		*
26	Asian koel	<i>Eudynamys scolopacea</i>		*				*	
27	Small green billed malkoha	<i>Phaenicophacus viridirostris</i>		*				*	*

28	Lesser coucal	<i>Centropus bengalensis</i>		*	*	*	*	*	*
29	Eurasian eagle owl	<i>Bubo bubo</i>		*	*		*		
30	Forest eagle owl	<i>Bubo nipalensis</i>		*			*		
31	Jugle owlet	<i>Glaucidium radiatum</i>	*	*	*	*	*		
32	Spotted owlet	<i>Athene brama</i>				*	*		*
33	Crested tree swift	<i>Hemiprocne coronate</i>						*	*
34	Lesser pied kingfisher	<i>Ceryle rudis</i>					*		
35	Stork billed kingfisher	<i>Halcyon capensis</i>		*	*				
36	White breasted kingfisher	<i>Halcyon smyrnensis</i>		*	*		*		
37	Chestnut headed bee-eater	<i>Merops leschenaulti</i>						*	*
38	Small bee-eater	<i>Merops orientalis</i>						*	*
39	Indian roller	<i>Coracias benghalensis</i>	*	*	*		*	*	*
40	Common hoopoe	<i>Upupa epops</i>	*	*	*		*	*	*
41	Malabar grey hornbill	<i>Ocyrceros griseus</i>	*			*	*		
42	White cheeked barbet	<i>Megalaima viridis</i>	*	*	*	*	*	*	*
43	Brown headed barbet	<i>Megalaima zeylonica</i>	*	*	*	*	*	*	*
44	Crimson throated barbet	<i>Megalaima rubricapilla</i>			*	*	*	*	*
45	Coppersmith barbet	<i>Megalaima haemacephala</i>		*	*		*		*
46	Speckled piculet	<i>Picumnus innominatus</i>	*	*			*		*
47	Rufous woodpecker	<i>Celeus brachyurus</i>			*		*	*	
48	Small yellow naped woodpecker	<i>Picus chlorolophus</i>			*		*	*	*
49	Lesser golden backed woodpecker	<i>Dinopium benghalensis</i>	*	*	*	*	*	*	*
50	Greater golden backed woodpecker	<i>Chrysocolaptes lucidus</i>	*	*		*	*		
51	Great black woodpecker	<i>Dryocopus javensis</i>	*	*	*	*	*		
52	Heart spotted woodpecker	<i>Hemicircus canenete</i>			*	*	*		*

53	Black shouldered woodpecker	<i>Chrysocolaptes festivus</i>		*	*	*	*		*
54	Yellow fronted pied woodpecker	<i>Dendrocopos mahrattensis</i>	*	*		*	*	*	*
55	Indian pitta	<i>Pitta brachyyura</i>						*	*
56	Bengal bush lark	<i>Mirafra assamica</i>							*
57	Bay backed shrike	<i>Lanius vittatus</i>		*	*		*	*	*
58	Rufous backed shrike	<i>Lanius schach</i>						*	*
59	Brown shrike	<i>Lanius cristatus</i>	*	*	*		*	*	
60	Eurasian golden oriole	<i>Oriolus oriolus</i>		*			*	*	
61	Black headed oriole	<i>Oriolus xanthornus</i>	*	*	*	*	*		*
62	Black drongo	<i>Dicrurus macrocercus</i>	*	*	*		*	*	*
63	Ashy drongo	<i>Dicrurus leucophaeus</i>	*	*	*	*	*		*
64	White bellied drongo	<i>Dicrurus caerulescens</i>	*	*	*	*	*	*	*
65	Bronzed drongo	<i>Dicrurus aeneus</i>	*	*	*	*	*		*
66	Greater rocket tailed drongo	<i>Dicrurus paradiseus</i>	*	*	*	*	*		
67	Grey headed starling	<i>Sturnus malabaricus</i>		*	*	*	*		
68	Brahmini starling	<i>Sturnus pagodarum</i>	*	*		*	*	*	*
69	Rosy starling	<i>Sturnus roseus</i>		*				*	
70	Common myna	<i>Acridotheres tristis</i>	*	*	*	*	*	*	*
71	Common hill myna	<i>Gracula religiosa</i>	*	*	*	*	*		
72	Indian treepie	<i>Dendrocitta vagabunda</i>	*	*	*	*	*	*	*
73	Jungle crow	<i>Corvus macrorhynchos</i>		*	*		*	*	*
74	Pied flycatcher shrike	<i>Hemipus picatus</i>		*				*	*
75	Large woodshrike	<i>Tephrodornis gularis</i>		*			*	*	*
76	Common woodshrike	<i>Tephrodornis pondicerianus</i>	*	*	*		*	*	*
77	Large cuckoo shrike	<i>Coracina macei</i>	*	*	*		*	*	*
78	Black headed cuckoo shrike	<i>Coracina melanoptera</i>		*	*		*		*

79	Scarlet minivet	<i>Pericrocotus flammeus</i>	*	*	*	*	*		*
80	Small minivet	<i>Pericrocotus cinnamomeus</i>	*	*	*	*	*	*	*
81	White bellied minivet	<i>Pericrocotus erythropygus</i>						*	*
82	Common iora	<i>Aegithina tiphia</i>	*	*	*	*	*	*	*
83	Golden fronted chloropsis	<i>Chloropsis aurifrons</i>	*	*	*	*	*		*
84	Jerdons chloropsis	<i>Chloropsis cochinchinensis</i>		*	*		*	*	
85	Asian fairy blue bird	<i>Irena puella</i>		*	*	*	*		
86	Redwhiskered bulbul	<i>Pycnonotus jocosus</i>	*	*	*	*	*	*	*
87	Red-vented bulbul	<i>Pycnonotus cafer</i>	*	*	*	*	*	*	*
88	Yellow browed bulbul	<i>Iole indica</i>		*				*	
89	Black bulbul	<i>Hypsipetes leucocephalus</i>				*	*		
90	Indian scimigar babbler	<i>Pomatorhinus horsfieldii</i>		*					*
91	Yellow eyed babbler	<i>Chrysomma sinense</i>						*	*
92	Rufous bellied babbler	<i>Dumetia hyperythra</i>	*	*	*	*	*	*	*
93	Jungle babbler	<i>Turdoides striatus</i>		*			*	*	*
94	White headed babbler	<i>Turdoides affinis</i>		*			*		*
95	Asian brown flycatcher	<i>Muscicapa dauurica</i>		*			*		*
96	Black and orange flycatcher	<i>Ficedula nigrorufa</i>		*			*	*	*
97	Tickells blue flycatcher	<i>Cyornis tickelliae</i>	*	*	*	*	*	*	*
98	Grey headed flycatcher	<i>Culicicapa ceylonensis</i>	*				*	*	*
99	White browed fantail flycatcher	<i>Rhipidura aureola</i>		*	*		*	*	*
100	White throated fantail flycatcher	<i>Rhipidura albicollis</i>		*			*	*	*
101	Asian paradise flycatcher	<i>Terpsiphone paradisi</i>				*	*	*	
102	Streaked fantail warbler	<i>Cisticola juncidis</i>		*			*		

103	Ashy prinia	<i>Prinia socialis</i>	*	*	*	*	*	*	*
104	Common tailor bird	<i>Orthotomus sutorius</i>	*	*	*	*	*	*	*
105	Booted warbler	<i>Hippolaris caligata</i>	*	*	*	*	*	*	*
106	Orphan warbler	<i>Sylvia hortensis</i>						*	*
107	Common lesser white throat	<i>Sylvia curruca</i>	*	*	*	*	*	*	*
108	Common chiffchaff	<i>Phylloscopus collybita</i>					*	*	*
109	Greenish leaf warbler	<i>Phylloscopus trochiloides</i>		*	*	*	*	*	*
110	Pied bush chat	<i>Saxicola caprata</i>						*	*
111	Malabar whistling thrush	<i>Myiophonus horsfieldii</i>			*	*	*		
112	Orange headed thrush	<i>Zoothera citrine</i>	*	*	*	*	*		*
113	Eurasian black bird	<i>Turdus merula</i>		*	*		*		
114	Great tit	<i>Parus major</i>	*	*	*	*	*	*	*
115	Chestnut bellied nuthatch	<i>Sitta castanea</i>	*	*	*	*	*	*	*
116	Velvet fronted nuthatch	<i>Sitta frontalis</i>	*	*	*	*	*	*	
117	Forest wagtail	<i>Dendronanthus indicus</i>		*	*	*	*		
118	Large pied wagtail	<i>Motacilla maderaspatensis</i>				*	*		
119	Yellow wagtail	<i>Motacilla flava</i>				*	*		
120	Grey wagtail	<i>Motacilla cinerea</i>	*		*		*		
121	Nilgiri flycatcher	<i>Eumyias albicaudata</i>	*	*	*	*	*	*	*
122	Purple rumped sunbird	<i>Nectarinia zeylonica</i>			*	*	*	*	*
123	Purple sunbird	<i>Nectarinia asiatica</i>		*		*	*	*	*
124	Small sunbird	<i>Nectarinia minima</i>	*	*	*	*	*	*	*
125	Lotens sunbird	<i>Nectarinia lotenia</i>						*	*
126	Little spider hunter	<i>Arachnothera longirostra</i>				*	*		*
127	Oriental white eye	<i>Zosterops palpebrosus</i>	*	*	*		*	*	*
128	Yellow throated sparrow	<i>Petronia dantocollis</i>							*
129	Spotted munia	<i>Lonchura punctulata</i>							*

130	Black headed munia	<i>Lonchura Malacca</i>			*				*
131	Blue bearded bee-eater	<i>Nyctyornis athertoni</i>	*			*	*	*	
132	Jungle myna	<i>Acridotheres fuscus</i>		*			*		*
133	Scaly bellied green woodpecker	<i>Picus xanthopygaeus</i>				*	*		*
134	Black kite	<i>Milvus migrans</i>		*				*	
135	Sirkeer malkoha	<i>Phaenicophaeus leschenaultia</i>	*	*	*	*	*		
136	Orange breasted green pigeon	<i>Treron bicincta</i>						*	*
137	Green imperial pigeon	<i>Ducula aenea</i>						*	*
138	Brown capped pygmy woodpecker	<i>Dendrocopos nanus</i>	*			*	*		*

Note: DDS – Dry deciduous habitat with sparse weed intensity; DDH – Dry deciduous habitat with high weed intensity; DDVH – Dry deciduous habitat with very high weed intensity; MDH – Moist deciduous habitat with high weed intensity; MDVH – Moist deciduous habitat with very high weed intensity; SJL – Scrub jungle habitat with low weed intensity; SJM – Scrub jungle habitat with medium weed intensity
* - indicates the presence of species

Table 2: Avian characteristics of different habitats with different weed intensities at Mudumalai wildlife sanctuary

S#	Habitat	Weed intensity	Number of species	Number of Birds (No./km ²)	Diversity (H')
1	Dry deciduous	sparse	61	384	3.2
2	„	High	98	1900	3.4
3	„	Very high	107	1957	3.5
4	Moist deciduous	High	77	779	3.4
5	„	Very high	115	1720	3.5
6	Scrub jungle	Low	93	1683	3.3
7	„	medium	117	2895	3.4

DISCUSSION:

Weed distribution

Elevation, habitat disturbance, rainfall and fire seemed to have major influence on the intensity and pattern of weed distribution.

At 900 – 950 m elevation, the weed distribution status was low; between 950 – 1000 m elevation the weed intensity was high; from 1000 – 1100 m elevation the weed distribution was sparse. Both *Lantana* sp. and *Eupatorium* sp. distribution follow the above pattern with regard to elevation.

Weed invasion was very high where human interference was high. In tourism zone compartments 1, 3 – 25, the weed intensity was high. These

compartments were altered for tourism improvements such as provision of salt licks, water holes, roads and watch towers, which attract visitors. Dry deciduous high weed areas are also characterized by human settlements.

Rainfall might also have played a significant role in weed invasion as lower (600-800mm) and higher (1800-2000 mm) rainfall areas are affected with low weed intensity and the medium (1000 – 1200mm) rainfall areas are affected severely by weed invasion.

Another factor that might have influenced weed distribution is fire; as severely fire affected areas of previous years were highly invaded by weeds. In previous years, the fire frequency was very high in

dry deciduous areas especially in tourism zone, which is also having high weed intensity.

Avian diversity and weeds

Weed intensity was found to increase the avian diversity (table 2). The bird species richness was also more in high weed intensity areas (vide table 2) *Lantana* sp. is a major food plant for various frugivorous birds and omnivorous birds. These exotic plants especially *Lantana* sp. also helps the birds to breed and hide. The common peafowl was previously (before more weed invasion) distributed Mudumalai in very less numbers but now the population is very high. In low weed areas the common peafowl distribution is very less and in high weed intensity areas the peafowl distribution is also very high.

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