

Faunal diversity of Jarawa Reserve and Ethnobiological study of Jarawa Tribe, South Andaman

C. Sivaperuman^{1,*}, S.A. Awaradi², Smitanjali Choudhury¹, G. Gokulakrishnan¹, Minakshi Dash¹, Apurba Kumar Das¹, Sumit Kumar Rao¹, Sant Kumar¹ and D. Deivaprakasam¹

¹Zoological Survey of India, Andaman and Nicobar Regional Centre, Haddo, Port Blair - 744 102, A & N Islands

²Andaman and Nicobar Tribal Research & Training Institute (ANTRI), Haddo, Port Blair - 744 102, A & N Islands

*Corresponding author e-mail: c_sivaperuman1@rediffmail.com

Abstract

Andaman and Nicobar archipelago have an enormous faunal and floral diversity along with five Particularly Vulnerable Tribal Groups (PVTGs) viz. Jarawa, Onge, Andamanese, Sentinelese and Shompen. Except for the semi-urbanised Andamanese, rest of the ethnic communities are mainly dependent on the traditional medicine for their primary health care. The Jarawa tribe belonging to the Negrito stock continues with hunting and gathering way of life. At present the Jarawas inhabit the western coastal region of the South and Middle Andaman Islands. These days, the indigenous knowledge system is fast fading away due to urbanization. At such juncture, the ethnobiological information regarding the remedial use of various indigenous animals and plants in traditional medicine by the Jarawa tribe has been documented. We have collected data through field survey, questionnaires, interviews, and discussions with 12 Jarawa respondents. This survey revealed that 18 species of animals and 26 plants are used to treat around 25 different ailments. Besides, we have documented 81 species and subspecies of butterflies, nine species of Odonata and 41 species of Moths, 49 species of spiders, 26 species of herpetofauna, 75 species of birds, and seven species of mammals from the Jarawa Reserve Forests of South Andaman.

Keywords: *Ethnobiology; Faunal diversity; Indigenous people; Jarawa Reserve Forest; Traditional medicine*

Introduction

The Andaman and Nicobar Islands are a small group of about 836 islands, islets, and rocky outcrops in the Bay of Bengal spread over an area of roughly 8,200 km (Jayaraj and Andrews, 2005). The total geographic area of Andaman and Nicobar Islands is 8249 km², of which, the Andaman group of islands cover 6408 km², while the Nicobar group covers 1841 km². Andaman and Nicobar Islands support very luxuriant and rich vegetation due to tropical hot and humid climate with abundant rains. As per the Champion and Seth (1968), Classification of Forest Types, the forests of Andaman and Nicobar Islands belong to four groups, i.e., Tropical Wet Evergreen, Tropical Semi Evergreen, Tropical Moist Deciduous and Littoral & Swamp Forests, which are further categorized into 13 different Forest Types. The total geographical area under forest cover is 6,742.78² km (81.74 per cent) as per the State Forest Report of 2019. Of these, 5,677.52 km² is very dense forests, 683.89² km is moderately dense

forests (MDF), and 381.52² km is under open forests. The forest cover has increased by 0.78² km as compared with the previous year report of 2017 (FSI, 2019).

The Jarawa aborigines belonging to Negrito racial stock, as of now inhabit the coastal region of South and Middle Andaman Islands and continue to lead the primordial hunting and gathering way of life. The term Jarawa in common parlance was synonymous with hostility and nudity in pre-1997 days. In the Aka-bea Andamanese language the word 'Jarawa' means "stranger". However, the Jarawas call themselves as "Ang" while the non-tribal people are referred as "eenen" by Jarawas. The Jarawa language is yet to be studied in depth. However, preliminary studies indicate that the sound system of the Jarawa language attests 13 vowel phonemes and 26 consonant phonemes. The word system of the language attests six-word classes, namely, noun, pronoun, verb, adjective, adverb and particle (Raja Singh, 2002).

The Jarawas now largely confine to the forest area of about 765 km² along the west coast of South and Middle Andaman Islands. This area has now been declared 'Jarawa Reserve' under Andaman and Nicobar Islands (Protection of Aboriginal Tribes) Regulation, 1956. Probably the Jarawas were the later migrant to this area (Cipriani, 1955; Radcliff-Brown, 1922). The Jarawa tribe has three socially discernible territorial divisions viz. Northern Group occupying Western part of Middle Andaman, Central and Southern Group occupying

Western part of South Andaman Island. The Northern Group is known among the Jarawas as Tanmad and as 'Kadamtala Jarawa' among non-tribal people. Southern Group is known as Boiab among Jarawas and local people call them as 'Tirur Jarawas'. The Central Group is known as Thidong among the Jarawa and among non-tribal people it is known as 'RK Nallah Jarawas'. This study was carried out in the Jarawa Reserve Forests of Tirur, Jirkatang and Middle Strait areas of South Andaman Islands (Fig. 1).

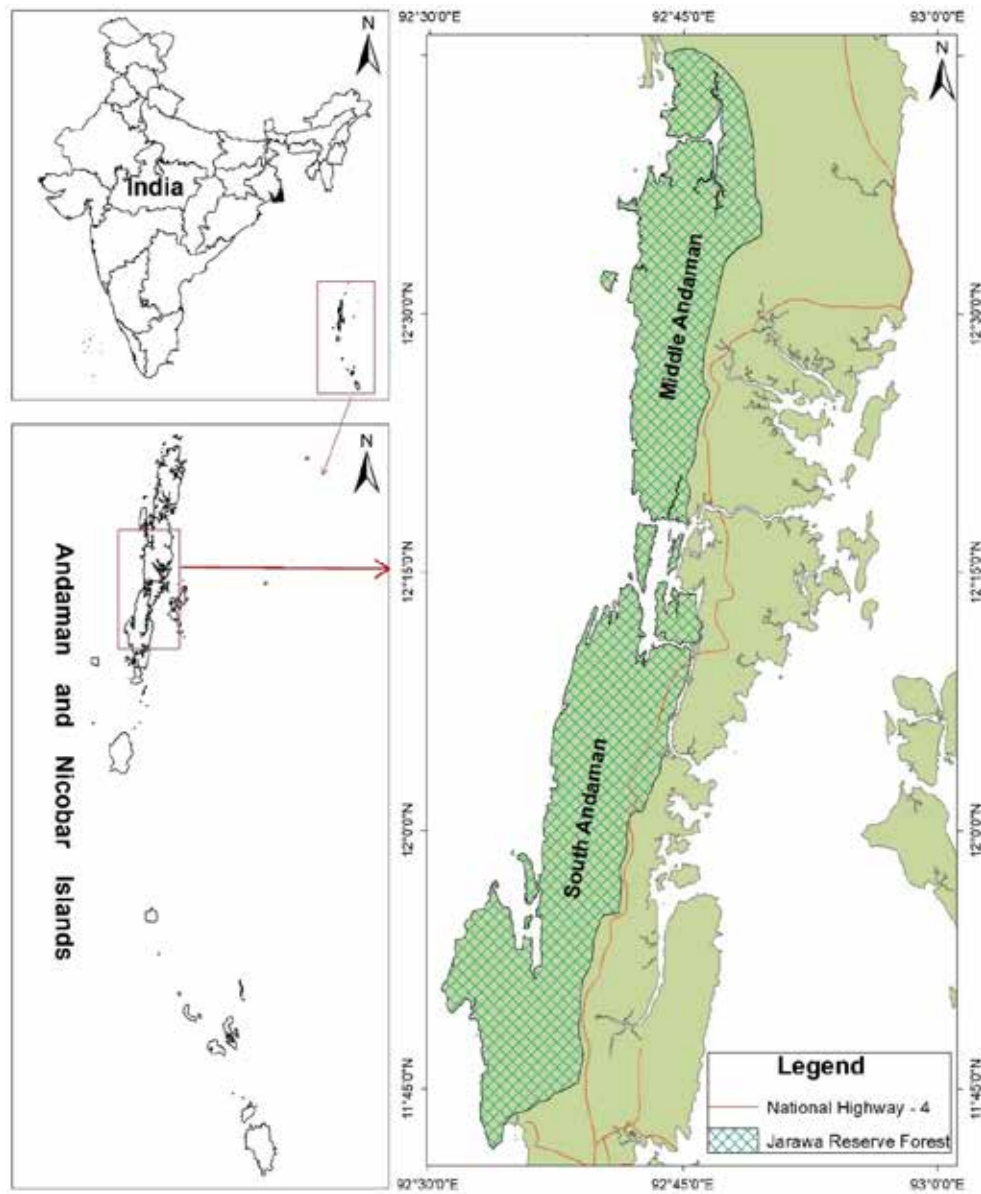


Fig. 1. Location map of Jarawa Reserved Forest and showing the study site

Climate

The South and Middle Andaman district enjoy the tropical humid climate because of their location in the equatorial zone surrounded by the Andaman Sea. Winter is virtually absent, and the islands have only two seasons viz., summer and rainy. Relative humidity varies from 79 to 89% and wind speed varies from 7-10 km/h. The maximum and minimum temperatures in the islands fluctuate between 27-33 and 21-25 °C, respectively. Daily evaporation rate in the island is fairly high, which

cumulatively ranges from 1500-1800 mm per annum, which could be attributed to the geographical localization.

Methods

Surveys were carried out during May 2019 in different locations in Jarawa Reserve Forest areas of Tirur, Jirkatang and Middle Strait of South Andaman Islands for a period of two weeks (Table 1). In addition to the data collected during this field survey, the available data from the previous surveys by the Zoological Survey of India has also been consulted for the preparation of this article.

Table 1 GPS coordinates of the study sites of Jarawa Reserved Forests

Area	Latitude	Longitude
Jirkatang - 9 km	11° 54.363' N	092° 39.952' E
Jirkatang - 12 km	11° 55.576' N	092° 40.437' E
Tirur	11° 44.121' N	092° 36.783' E
Middle Strait	12° 09.411' N	092° 45.210' E

Medicinal Plants

Survey was carried out in the different locations of Jarawa reserve, namely Tirur, Jirkatang, and Middle Strait to assess the medicinal plants which the Jarawas are using to cure various ailments in day-to-day life. Information on the plant species used by Jarawa was obtained during the ethno-botanical survey. Group of Jarawas were also interviewed from different places such as Tirur, Jirkatang and Middle Strait. Most of the Jarawas understood Hindi language used during the discussions; the assistance of field officials of welfare agency the AAJVS (Andaman Adim Janjati Vikas Samiti) was utilised to translate and interpret the Jarawa explanations about traditional medicine. The data collected about the plants from the Jarawa area were checked and compared with the available literature and hence reconfirmed. The information presented in tabular form according to their use by the Jarawas.

Butterflies

Butterflies were observed by the line transect method (Pollard, 1977; Pollard and Yates, 1993) for a distance of 600 mtr. during morning hours from 06.00 am to 11.00 am. Butterflies were identified in the field with the help of a field guide (Kehimker, 2016).

Odonata

Odonata were collected by netting and sweeping methods.

Moths

Moths were collected using a light trap consisting of one 185 W mercury vapour lamp, powered by a portable generator (Honda EP1000) placed in front of a 5 × 4 ft. vertical white cotton screen. The screen was illuminated for about 1 h. Before collection, moths were photographed using a digital camera. Moths were collected using killing jars and brought to the laboratory for further identification.

Spiders

Spiders were collected from eight locations at Tirur (4 sites) and Jirkatang (4 sites) areas of the South Andaman Jarawa Reserve Forest. Hand collection and aerial hand picking were used for sampling of spiders. Only low, primarily herbaceous or shrubby vegetation was swept. Being soft-bodied, spiders cannot be preserved satisfactorily in a dry state, as they shrivel. Therefore, Oude-man's preservative was used: 85 parts 70% ethyl alcohol, 5 parts glycerine, and 5 parts glacial acetic acid. Care was taken not to place too many specimens in the

preservative, and it was changed after 1-2 days, as it becomes diluted with body fluids. The specimens were kept in vials with the same preservative for permanent storage.

Photographing and Preservation for Illustrations:

Newly collected specimens were anesthetized with either, ethyl acetate or CO₂ and then posed dry on host plants. This was promptly done while the spider was still immobilized with flexible legs and palpi. For morphological examination, most specimens came from the preserved state except when indicated in the description.

Reptiles and Amphibians

Random surveys were conducted to document amphibians and reptile species. The streams and marshy areas were surveyed for amphibians. Hand picking and pitfall traps were employed for collecting specimens. Dip nets were used for capturing amphibians of lentic systems. Amphibians and reptiles were identified in the field itself as far as possible. The specimens were photographed for confirmation of identification and voucher specimens were collected and preserved in 10% formaldehyde. The specimens were identified using field guide (Boulenger, 1890; Smith, 1933; 1935; 1943; Daniel, 1963).

Birds

A visual encounter survey was conducted by transects method (Burnham *et al.*, 1980). The observation of the birds was carried out in early morning and evening hours by using field binocular (Nikon 8 × 42 and Nikon spotting scope 15 × 45) during the daytime depending on the light conditions. Nocturnal birds were identified by listening to their calls while sitting at a site. The practice was repeated at dusk (18:00–20:00 h), midnight (23: 00 h) and dawn (4: 00 h). Dusk period was revealed to be an adequate time for such surveys as most of the birds either come out or go to their respective roosts. Birds were identified on the

basis of physical features with the help of field guides (Ali and Ripley, 1983; Grimmett *et al.*, 1998).

Mammals

The Block count and Point count methods (Direct and Indirect) were used for census of the mammals (Burnham *et al.*, 1980). The indirect evidences such as pugmarks, pellets, dung and footprints also recorded following Rodgers (1991).

Direct sightings: The study area was surveyed on foot randomly. Whenever a mammal is sighted, details in respect of size, sex, group size, activity, time of sighting and vegetation type were recorded.

Indirect evidence: As an alternative to the block count method, a 10 m × 10 m quadrates were laid and indirect evidences of mammals such as scats, droppings, diggings, feeding signs and scratching marks were identified (Rodgers, 1991).

Results and Discussion

Medicinal Plants Resources of Jarawa Tribe

Jarawas being the foragers do not cultivate the crops, except for planting in few small patches near their camps the seedlings of banana, jackfruit, mango, coconut, papaya supplied by AAJVS, and this practice was initiated among Jarawas in late 1980s by the Contact Expedition team of A & N Administration. Plants and their parts as intact or in the crushed form were used for medicine by the Jarawas were applied externally. Table 2 indicates details of the plants, their parts and the ailments / purpose for which they are used. The photos of plants used for medicinal purposes are provided at Plate 1. While during the ethno-medicinal study on the Jarawa tribe, we were observed that they have collected wild fruits for consumption. part from medicinal plants, Jarawas gather a variety of seasonal fruits for consumption and these are presented in Plate 2.



Trichosanthes tricuspidata Lour.



Anaxagorea luzonensis A. Gray



Curcuma zedoaria (Christm.) Roscoe



Caryota mitis Lour.



Knema andamanica (Warb.) W.J.de Wilde



Myristica andamanica Hook.f.



Nypa fruticans Wurm



Orophea katschallica Kurz

Plate 1. Plants used for medicinal purposes by Jarawa Tribes

Table 2. Plant products used to traditional medicine by Jarawa Tribes

Sl. No.	Botanical Name	Family	Jarawa Name	Part used	Purpose
1.	<i>Dracaena angustifolia</i> Roxb.	Agavaceae	Tidba	Twigs	Clean genitals during the menstrual period
2.	<i>Angiopteris lygodifolia</i> Roscut	Angiopteridaceae	-	Young leaves	Cough, cold
3.	<i>Anaxagorea luzonensis</i> A. Gray	Annonaceae	Inetha	Leaf	Body pain
4.	<i>Goniothalamus macranthus</i> (Kurz) Boerl.	Annonaceae	Omiya nada	Leaf	Fever & Body pain
5.	<i>Orophea katschallica</i> Kurz	Annonaceae	Thanko bajeta	Leaf	Fever & Cold
6.	<i>Pseuduvaria prainii</i> (King) Merr.	Annonaceae	Hoomal	Leaf & Bark	Fever, Cold, Stomach pain, Joint pain, Ear & Eye pain
7.	<i>Maasia glauca</i> (Hassk.) Mols, Kessler & Rogstad	Annonaceae	Keka	Leaf	Fever, Cold & Cough
8.	<i>Areca triandra</i> Roxb. ex Buch.-Ham.	Arecaceae	Thaad	Tender shoots	Cough
9.	<i>Caryota mitis</i> Lour.	Arecaceae	Endau	Tender shoots	Stomach pain & Vomiting
10.	<i>Nypa fruticans</i> Wurm	Arecaceae	Thuia	Tender leaf	Headache, Insect bite & Body pain
11.	<i>Thottea tomentosa</i> (Blume) Ding Hou	Aristolochiaceae	Udupet	Whole plant	Cough & Fever
12.	<i>Chromolaena odorata</i> (L.) R.M. King & H. Rob.	Asteraceae	Auth	Leaf	Coagulant
13.	<i>Ageratum conyzoides</i> Linn.	Asteraceae	Aaktel	Tender leaves	Fever, throat pain
14.	<i>Canarium commune</i> Linn.	Burseraceae	Pepethale	Headed leaves	Headache
15.	<i>Carica papaya</i> L.	Caricaceae	Thala	Raw fruits	Prophylactic
16.	<i>Trichosanthes trispidata</i> Lour.	Cucurbitaceae	Urubethe	Whole plant	Throat pain
17.	<i>Kunstleria keralensis</i> C.N. Mohanan & N.C. Nair	Fabaceae	Gowato/Quato	Bark	Fever, Headache & Body pain
18.	<i>Gnetum scandens</i> Roxb.	Gnetaceae	Ehole	Stem sap	Stomach pain
19.	<i>Knema andamanica</i> (Warb.) W.J. de Wilde	Myristicaceae	Oro/Horo	Leaf	Fever, Dizziness & Coagulant
20.	<i>Myristica andamanica</i> Hook. f.	Myristicaceae	Oro	Leaf & Stem sap	Fever, Body pain, Wounds & Insect bite
21.	<i>Pandanus andamanensis</i> Kurz.	Pandanaceae	Thadow, Paliyu	Leaves	Body Pain
22.	<i>Piper betle</i> L.	Piperaceae	Intoto	Leaf	Headache & Body pain
23.	<i>Rhizophora apiculata</i> Blume	Rhizophoraceae	Watole	Leaf & Fruit	Cut & Wound
24.	<i>Prunus javanica</i> (Teijsm. & Binn.) Miq.	Rosaceae	Wate	Bark	Labour pain
25.	<i>Amomum aculeatum</i> Roxb.	Zingiberaceae	Huia	Stem	Coagulant, Leg sprain, Fever & Headache
26.	<i>Curcuma zedoaria</i> (Christm.) Roscoe	Zingiberaceae	Oyekuchin	Leaf	Cold & Cough



Diospyros andamanica (Kurz) Bakh.



Ximelia americana Linn.



Manilkara littoralis (Kurz) Dubard



Baccaurea ramiflora Lour.



Pomettia pinnata J.R.Forst. & G.Forst.



Calamus longisetus Griff.



Artocarpus chama Buch.-Ham.



Nypa fruticans Wurmbe



Phoenix paludosa Roxb.



Cyceas rumphii Miq.



Artocarpus lacucha Buch.-Ham.



Calamus andamanicus Kurz



Dracontomelon dao (Blanco) Merr. & Rolfe



Syzygium samarangense (Blume) Merr. & L.M.Perry



Garcinia xanthochymus Hook.f. ex T.Anderson

Plate 2. Edible fruits consumed by the Jarawa tribes

Butterflies

During the period of study, a total of 81 species and subspecies of butterflies belonging to five families was recorded from Jarawa reserved areas (Table 3). Some of the species photographs are illustrated in Plate 3. Most of the butterflies were recorded from the family Nymphalidae (24 species; 22.63%) followed by Lycaenidae (22 species; 27.16%), Hesperidae (17 species; 20.99%), Pieridae (10 species; 12.35%), and Papilionidae (8 species; 9.88%). In the previous studies from Andaman showed a similar type of the distribution pattern of butterflies with the dominance of the family Nymphalidae (Davidar *et al.*, 1994; Sivaperuman *et al.*, 2014; Sivaperuman and Venkataraman, 2012). Among the recorded species of butterflies, 30 species were common (37.04%), 13 species were very common (16.05%), 27 species were rare (33.33%) and 11 species were very rare (13.58%). The most diverse genus is *Neptis* with 4 subspecies, followed by *Papilio* and *Hasora* contributing 3 species each. Previously, Davy *et al.* (1994) recorded 65 species of butterflies from the Andaman Islands with 30% were rare species, 50% of the species were common and 20% were uncommon. The present results are comparable with the previous observations made by Davy *et al.* (1994).

The vegetation is mixed forests, tropical evergreen and coastal forests, which support wide range of habitats. Many species of butterflies preferred more than one type of habitats, like Lycaenids and Pierids were frequently seen in the forest edges and coastal forest, while Nymphalidae and Papilionidae were commonly seen in the mixed and tropical evergreen forest. Whereas, Hesperidae were seen in all types of vegetation. It was observed that variety of factors influencing the species richness of Jarawa reserved. The forest inhabited by the Jarawa is protected since it is notified as tribal reserve. Most of the reserved forests

lie in the western coast of South Andaman, having a rich flora and fauna in this region. The area has a thick forest cover and supports a wide range of larval and adult food plants. It implies that many butterfly species are specific in their habitat requirements and hence consider as a good indicator of the habitat diversity of an area (Kocher and William, 2000; Bonebrake *et al.*, 2010; Thomas, 2005).

Our study revealed that this forest is rich in butterfly diversity that are endemic and rare, of which 13 species are legally protected under the Wildlife Protection Act 1972. These include Andaman Autumn Leaf *Doleschallia bisaltide andamanensis*, Andaman Common Pierrot *Castalius rosimon alarbus*, Cornelian *Deudorix epijarbas amatius* are protected under Schedule-I, while Andaman Small Leopard *Phalanta alcippe andamana*, Andaman Clipper *Parthenos sylvia roepstorffii*, Andaman Great Jay *Graphium eurypylus macronius*, Andaman Common Rose *Pachliopta aristolochiae goniopeltis*, Common Albatross *Appias albina darada*, Andaman Plane *Bindahara phocides phocides*, Andaman Malayan *Megisba malaya presbyter* Andaman Large Four Line-blue, *Nacaduba pactolus andamanica* in schedule II and Andaman Plain Banded Awl *Hasora vitta manda*, Tree Flitter *Hyarotis adrastus praba* are protected in Schedule-IV. The protected areas are important in preserving the existing populations of species and to reduce extinction rates, where some of the populations of some species are contracted largely to the protected areas (Thomas, 2005; Klorvuttimontara *et al.*, 2011). The majority of the species depends upon the tropical forest but, the destruction and climate changes of the tropical rain forest is occurring at an alarming rate (Matthews *et al.*, 2014), which has a serious impact on the protected areas. More field surveys and long-term monitoring are required on the butterfly fauna of Jarawa tribal reserve to understand diversity, distribution and conservation.

Table 3. List of Butterflies observed at Jarawa Reserved Forests

Sl. No.	Common Name	Scientific Name	WPA
NYMPHALIDAE			
1.	Grey Pansy	<i>Junonia atlites</i> (Linnaeus, 1793)	
2.	Andaman Small Leopard	<i>Phalanta alcippe andamana</i> (Fruhstorfer, 1904)	II
3.	Andaman Viscount	<i>Tanaecia cibaritis</i> Hewitson, 1874	
4.	Andaman Clipper	<i>Parthenos sylvia roepstorffii</i> Moore (1897)	II
5.	Andaman Crow	<i>Euploea andamanensis</i> Atkinson (1874)	
6.	Andaman Common Sailer	<i>Neptis hylas andamana</i> Moore, 1877	
7.	Andaman Baron	<i>Euthalia acontius</i> (Hewitson, 1874)	
8.	Common Medus Brown	<i>Orsotriaena medus medus</i> Evans, 1932	
9.	Andaman Glassy Tiger	<i>Parantica aglea melanoleuca</i> (Moore, 1877)	
10.	Dark Branded Bush-brown	<i>Mycalesis mineus mineus</i> (Linnaeus, 1758)	
11.	Andaman Palm fly	<i>Elymnias hypermnestra cottonis</i> (Hewitson, 1874)	
12.	Bengal Leopard Lacewing	<i>Cethosia cyane</i> (Drury, 1773)	
13.	Andaman Rustic	<i>Cupha erymanthis andamanica</i> Moore (1900)	
14.	Great Egg fly	<i>Hypolimnus bolina jacintha</i> (Drury, 1773)	
15.	Andaman Tree Nymph	<i>Idea agamarschana cadelli</i> (Wood Mason & de Niceville, 1880)	
16.	Oriental Peacock Pansy	<i>Junonia almanac</i> (Linnaeus, 1758)	
17.	Oriental Common Evening Brown	<i>Melanitis leda leda</i> (Linnaeus, 1758)	
18.	Andaman Sullied Sailer	<i>Neptis clinia clinia</i> Moore, 1872	
19.	Andaman Chestnut Streaked Sailer	<i>Neptis jumbah amorosca</i> Fruhstorfer, 1905	
20.	Andaman Clear Sailer	<i>Neptis nata evansi</i> Eliot 1969	
21.	Andaman Cruiser	<i>Vindula erota pallida</i> Staudinger, 1885	
22.	White Banded Lascar	<i>Pantoporia cnacalis</i> (Hewitson, 1874)	
23.	Andaman Great Duffer	<i>Doleschallia bisaltide andamanensis</i> Fruhstorfer, 1899	I
24.	Oriental Blue Tiger	<i>Tirumala limniace exoticus</i> (Gmelin, 1790)	
PAPILIONIDAE			
25.	Andaman Tailed Jay	<i>Graphium agamemnon andamana</i> (Lathy, 1907)	
26.	Andaman Great Jay	<i>Graphium eurypylus macronius</i> (Jordan, 1909)	II
27.	Andaman Clubtail	<i>Losaria rhodifer</i> (Butler, 1876)	
28.	Andaman Common Rose	<i>Pachliopta aristolochiae goniopeltis</i> (Rothschild, 1938)	
29.	Andaman Mormon	<i>Papilio mayo</i> Atkinson (1874)	II
30.	Lime Butterfly	<i>Papilio demoleus demoleus</i> Linnaeus, 1758	
31.	Andaman Common Mormon	<i>Papilio polytes stichioides</i> Evans, 1912	
32.	Andaman Common Birdwing	<i>Troides helena heliconoides</i> (Moore, 1877)	
PIERIDAE			
33.	Common Grass Yellow	<i>Eurema hecabe hecabe</i> (Linnaeus, 1758)	
34.	Andaman One-spot Grass Yellow	<i>Eurema andersoni evansi</i> Corbet & Pendlebury, 1932	
35.	Andaman Tree Yellow	<i>Gandaca harina andamana</i> Moore (1906)	
36.	Common Albatross	<i>Appias albina darada</i> (C. & R. Felder, 1865)	II
37.	Andaman Great Orange Tip	<i>Hebomoia roepstorffii</i> Wood-Mason, 1880	
38.	Andaman Common Gull	<i>Cepora nerissa lichenosa</i> (Moore, 1877)	
39.	Oriental Psyche	<i>Leptosia nina nina</i> (Fabricius, 1793)	
40.	Andaman Dark Wanderer	<i>Pareronia ceylanica naraka</i> (Moore, 1877)	

41.	Andaman Yellow Orange Tip	<i>Ixias pyrene andamana</i> Moore, 1877	
42.	Painted Jezebel	<i>Delias hyparete metarete</i> Butler, 1879	
	LYCAENIDAE		
43.	Andaman Centaurus Blue	<i>Arhopala centaurus coruscans</i> Wood-Mason & de Niceville, 1880	
44.	Purple Leaf-blue	<i>Amblypodia anita andamanica</i> (Riley, 1922)	
45.	Andaman Plane	<i>Bindahara phocides phocides</i> (Fabricius, 1793)	II
46.	Elbowed Pierrot	<i>Caleta elna noliteia</i> (Fruhstorfer, 1918)	
47.	Andaman Common Pierrot	<i>Castalius rosimon alarbus</i> Fruhstorfer, 1922	I
48.	Andaman Silver Forget-me-not	<i>Catochrysops panormus andamanica</i> Tite, 1959	
49.	Forget-me-not	<i>Catochrysops strabo strabo</i> (Fabricius, 1793)	
50.	Andaman Sunbeam	<i>Curetis saronis saronis</i> Moore, 1877	
51.	Cornelian	<i>Deudorix epijarbas amatius</i> Fruhstorfer, 1912	I
52.	Gram Blue	<i>Euchrysops cnejus</i> (Fabricius, 1798)	
53.	Andaman Common Tit	<i>Hypolycaena erylus andamana</i> Moore, 1877	
54.	Andaman pointed Lineblue	<i>Ionolyce helicon brunnea</i> (Evans, 1932)	
55.	Andaman Common Cerulean	<i>Jamides celeno blairana</i> Evans, 1925	
56.	Andaman Yamfly	<i>Loxura atymnu sprabha</i> (Moore, 1877)	
57.	Plain Cupids	<i>Luthrodes pandava</i> (Horsfield, 1829)	
58.	Andaman Malayan	<i>Megisbamalaya presbyter</i> Fruhstorfer, 1918	II
59.	Andaman Quaker	<i>Neopithecops zalmora andamanus</i> Eliot & Kawazoe, 1983	
60.	Long Banded Sliverline	<i>Spindasis lohita zoilus</i> (Moore, 1877)	
61.	Burmese Acacia blue	<i>Surendra vivarna latimargo</i> Moore, 1879	
62.	Lesser Grassblue	<i>Zizina otis otis</i> Fabricius, 1787	
63.	Andaman Large Fourlineblue	<i>Nacaduba pactolus andamanica</i> Fruhstorfer, 1916	II
64.	State Flash	<i>Rapala manea schistacea</i> (Moore, 1879)	
	HESPERIIDAE		
65.	Brown Awl	<i>Badamia exclamationis</i> (Fabricius, 1775)	
66.	Common Rice Swift	<i>Borbo cinnara</i> (Wallace, 1866)	
67.	Palm Red Eye	<i>Erionota thrax thrax</i> (Linnaeus, 1767)	
68.	Banded Redeye	<i>Gangara lebadea andamanica</i> (Wood-Mason & de Niceville, 1881)	
69.	Giant Redeye	<i>Gangara thyrsis thyrsis</i> (Fabricius, 1775)	
70.	Common Banded Awl	<i>Hasora chromus chromus</i> (Cramer, 1780)	
71.	Moore's Ace	<i>Halpe porus</i> (Mabille, 1877)	
72.	Andaman White banded Awl	<i>Hasora taminatus andama</i> Evans, 1949	
73.	Andaman Plain Banded Awl	<i>Hasora vitta manda</i> Evans, 1949	IV
74.	Tree Flitter	<i>Hyarotis adrastus praba</i> (Moore, 1866)	IV
75.	Common Redeye	<i>Matapa aria</i> (Moore, 1866)	
76.	Restricted Demon	<i>Notocrypta curvifascia curvifascia</i> (C. & R. Felder, 1862)	
77.	Andaman Common Dartlet	<i>Oriens gola gola</i> (Moore, 1877)	
78.	Malay Dartlet	<i>Oriens paragola</i> de Niceville, 1895	
79.	Andaman Large Snow Flat	<i>Tagiades gana alica</i> Moore, 1877	
80.	Andaman Suffused Snow Flat	<i>Tagiades japetus ravina</i> Fruhstorfer, 1910	
81.	Andaman Water Snow Flat	<i>Tagiades litigiosa andamanica</i> Evans, 1932	



Plate 3. Butterflies at the Jarawa Reserved Forests.

A *Loxura atymnus prabha* Moore, *B* *Parthenos sylvia roepstorffii* Moore, *C* *Phalanta alcippe andamana* Fruhstorfer, *D* *Junonia atlites* Linn, *E* *Neptis hylas andamana* Moore, *F* *Euploea core andamanensis* Atkinson

Moths

Lepidoptera (Butterflies and Moths) is one of the most taxonomically diverse insect orders with approximately 160,000 described species (van Nieuwerkerken *et al.*, 2011). Moths are mostly nocturnal and play an important role in the ecosystem acting as pollinators, herbivores, prey for many predators, ecological indicators and many species are economically important. Moths feed on nectar, ripen or rotten fruits and some feed on decaying plant or animal matter. Caterpillars of many species feed on the tender

leaves of their host plant. Micro-moths of economic importance feed on clothes, wool and stored grains, etc. (Shubhalaxmi, 2018).

A total of nine species of Odonata and 41 species of Moths (Tables 4 and 5) was reported from the study area. Odonata was found abundantly in Tirur Jarawa Reserve Forest because of the presence of a large fresh water source, which acts as a feeding site for adults and breeding site for larvae. The photographs are depicted in Plate 4.

Table 4. List of Odonata observed in Jarawa Reserved Forests

Sl. No.	Common Name	Species Name
	Phylum: Arthropoda von Siebold, 1848	
	Class: Insecta Linnaeus, 1758	
	Order Odonata Fabricius, 1793	
1.	Clear-winged Forest Glory	<i>Vestalis gracilis gracilis</i> (Rambur, 1842)
2.	Blue Grass Dartlet	<i>Pseudagrion microcephalum</i> (Rambur, 1842)
3.	Black Bambootail	<i>Prodasineura verticalis andamanensis</i> (Fraser, 1924)
4.	Common Picture Wing	<i>Rhyothemis variegata</i> (Linnaeus, 1763)
5.	Grasshawk Skimmer	<i>Neurothemis fluctuans</i> (Fabricius, 1793)
6.	Asiatic Blood Tail	<i>Lathrecista asiatica</i> (Fabricius, 1798)
7.	Green Marsh Hawk	<i>Orthetrum sabina sabina</i> (Drury, 1770)
8.	Yellow Bush Dart	<i>Copera marginipes</i> (Rambur, 1842)
9.	Ground Skimmer	<i>Diplacodes trivialis</i> (Rambur, 1842)

Table 5. List of Moths observed in Jarawa Reserved Forests

Sl. No	Common Name	Species Name
1.	Atlas moth	<i>Attacus atlas</i> (Linnaeus, 1758)
2.	Drury's jewel	<i>Cyclosia papilionaris nigrescens</i> Moore, 1877
3.	Yellow vein Snout Tiger	<i>Asota egens andamana</i> (Walker, 1854)
4.	White banded snout Tiger	<i>Asota heliconia</i> (Linnaeus, 1758)
5.	Blue Line scarlet Moth	<i>Sympis rufibasis</i> Guenee, 1852
6.	Yellow under wing lichen Moth	<i>Brunia antica</i> (Walker, 1854)
7.	Streaked Tiger	<i>Cretonotos gangis</i> (Linnaeus, 1763)
8.	Grey Swallowtail Moth	<i>Micronia aculeata</i> Guenée, 1857
9.	Large yam Hawkmoth	<i>Theretra nessus</i> (Drury, 1773)
10.	Common Hunter Moth	<i>Theretra clotho clotho</i> (Drury, 1773)
11.	Common owl Moth	<i>Erebus ephesperis</i> (Hübner, 1827)

12.	Orange Underwing Thyas	<i>Thyas coronata</i> (Fabricius, 1775)
13.	Grape Fruit Piercer	<i>Eudocima hypermnestra</i> (Cramer, 1780)
14.	Round Footmen	<i>Hemonia orbiferana</i> Walker, 1863
15.	-	<i>Euplocia membliaria</i> (Cramer, 1780)
16.	-	<i>Padenia duplicana</i> (Walker, 1863)
17.	-	<i>Lymtria</i> spp.
18.	-	<i>Avatha bubo</i> (Geyer, 1832)
19.	Pink Eyed Emerald	<i>Aporandria specularia</i> (Guenée, 1857)
20.	-	<i>Celerena andamana</i> Felder, 1875
21.	Banded Mango Moth	<i>Birhamoides junctura</i> Walker, 1865
22.	-	<i>Ambulyx canescens canescens</i> Walker, 1865
23.	-	<i>Angonyx testaeae lestacea</i> (Walker, 1856)
24.	Scholar tree Leaf Roller	<i>Glyphodes bicolor</i> (Swainson, 1821)
25.	Ficus Leaf Roller Moth	<i>Glyphodes bivitalis</i> Guenée, 1854
26.	Jackfruit Leaf Roller	<i>Glyphodes actorionalis</i> Walker, 1859
27.	Mango Leaf Roller	<i>Aetholix flavibasalis</i> Guenée, 1854
28.	Striped tear Sucker	<i>Tyspanodes linealis</i> (Moore, 1867)
29.	Teak Leaf Roller	<i>Sameodes cancellalis</i> (Zeller, 1852)
30.	Easter Tree Leaf Roller	<i>Cydalima laticostalis</i> Guenée, 1854
31.	Cotton Leaf Roller	<i>Haritalodes derogata</i> (Fabricius, 1775)
32.	Beet Webworm	<i>Spoladea recurvalis</i> Fabricius, 1775
33.	Bean pod Borer	<i>Maruca vitrata</i> (Fabricius, 1787)
34.	-	<i>Cydalima pfeifferae</i> (Lederer, 1863)
35.	-	<i>Polygrammodes sabelialis</i> (Guenée, 1854)
36.	-	<i>Cirrhochrista fumipalpis</i> C. Felder, R. Felder & Rogenhofer, 1875
37.	-	<i>Cotachena</i> spp.
38.	-	<i>Patania caletoralis</i> (Walker, 1859)
39.	-	<i>Prooedema inscisalis</i> (Walker, 1865)
40.	-	<i>Palpita annulifer</i> Inoue, 1996
41.	-	<i>Agrioglypta itysalis</i> (Walker, 1859)



Plate 4. Moths at the Jarawa Reserved Forests

A *Prooedema incisalis* (Walker, 1865); *B* *Aetholix flavibasalis* (Guenée, 1854); *C* *Arthroschista hilaralis* Walker, 1859; *D* *Glyphodes bivitalis* Guenée, 1854; *E* *Vitessa suradeva* Moore, 1860; *F* *Cretonotos gangis* (Linnaeus, 1763); *G* *Glyphodes actorionalis* Walker, 1859; *H* *Ambulyx canescens canescens* Walker, 1865; *I* *Isocentris filalis* (Guenée, 1854); *J* *Asota heliconia* (Linnaeus, 1758).

Spiders

Spiders belong to the order Araneae, which is one of the grasping animal's groups (Riechert and Lockely, 1984). The most important characteristic of spiders is the presence of carapace found on the dorsal side of the cephalothorax. Their jaws are called chelicerae, having fangs, which are used as piercing device for injecting venom. Spiders produce silk through spinnerets, located on the ventral side of the abdomen. Female spiders are larger than males. The female reproductive organ is called Epigynum, and it is situated on the ventral side of the abdomen. Breathing organs are trachea and book lungs (Nieuwenhuys, 2008). They vary in size and colors. The size of the giant bird eating spider, Theraphosid

(Thorell), is 75 mm, with leg length up to 255 mm. Their metamorphosis occurs through moulting, where their size is increased with replacement of hard and old skin with new one (Kingsley, 1999). They represent the hateful and injurious animals (Davy, 1994). In fact, they help to protect crops from pests (Fabre, 1999) as a biological pest control agent (Platnick, 1995). Their venom pollutes less than pesticides used in the agro-ecosystem (Novak, 2001), and testing for the treatment of heart disease (Davey, 1994). They inhabit the ground, underground tunnel systems, under stones and near water; but habitually, they like moist place. A total of 49 species of spiders under 12 families were recorded from these areas (Table 6). The photographs of some of the species are illustrated in Plates 5 and 6.

Table 6. List of Spiders from Jarawa Reserved Forests

Sl. No.	Species Name	Common Name
Phylum Arthropoda Lankester, 1904		
Class Arachnida Lamarck, 1801		
Order Araneae Clerck, 1757		
Family Araenidae Clerck, 1757		
1.	<i>Argiope aemula</i> Walckenaer, 1841	Oval St Andrew's Cross Spider
2.	<i>Argiope catenulata</i> (Doleschall, 1859)	Grass Cross Spider
3.	<i>Argiope pulchella</i> Thorell, 1881	Garden Orb Weavers
4.	<i>Arachnura angura</i> Tikader, 1970	Scorpion Tailed Spider
5.	<i>Cyclosa spirifera</i> Simon, 1889	Trashline Orb weavers
6.	<i>Cyclosa insulana</i> Costa, 1834	Trashline Orb weavers
7.	<i>Neoscona nautica</i> C.L. Koch, 1875	Brown Sailor Spider
8.	<i>Neoscona mokerjei</i> Tikader, 1980	Gangetic Delta Orb Weaver
9.	<i>Neoscona bengalensis</i> Tikader & Bal, 1981	Spotted Orb Weaver
10.	<i>Neoscona chrysanthusi</i> Tikader & Bal, 1981	Barn Spider
11.	<i>Nephilengys malabarensis</i> Walckenaer, 1841	Asian hermit Spider
12.	<i>Thelacantha brevispina</i> Doleschall, 1857	Double spotted spiny Spider
13.	<i>Gastercantha dalyi</i> Pocock, 1900	Spiny orb-weavers
14.	<i>Gastercantha kuhlii</i> C.L. Koch, 1838	Black and White Spiny Orb Weaver
15.	<i>Larinia phtisica</i> L. Kock, 1871	---
16.	<i>Larinia chloris</i> Audouin, 1826	---
17.	<i>Nephila pilipes</i> Fabricius, 1793	Golden Orb weaving spider
18.	<i>Parawixia dehanii</i> (Doleschall, 1859)	Abandoned-web Orb-weaver
19.	<i>Poltys pogonias</i> Thorell, 1891	Tree Stump Spider
20.	<i>Cyrtophora moluccensis</i> Doleschall, 1857	Tent-Web Spider
Family Hersilidae Thorell, 1870		

- | | | |
|-----|--|--|
| 21. | <i>Hersilia savignyi</i> Lucas, 1836
Family Oxyopodidae Thorell, 1870 | Two-Tailed Spider |
| 22. | <i>Oxyopes sitae</i> Tikader, 1970
Family Pholcidae C. L. Koch, 1851 | Lynx Spider |
| 23. | <i>Pholcus kapuri</i> Tikader, 1977
Family Pisauridae Simon, 1890 | Daddy long Leg Spiders |
| 24. | <i>Dendrolycosa gitae</i> Tikader, 1970
Family Psecridae Simon, 1890 | Nursery Web Spider |
| 25. | <i>Fecenia protensa</i> Thorell, 1891
Family Salticidae Blackwall, 1842 | Tangled Web Spider |
| 26. | <i>Hyllus pudicus</i> Thorell, 1895 | Semi-Coppered Heavy Jumper |
| 27. | <i>Menemerus albocinctus</i> Keyserling, 1890 | Gray Wall Jumpers |
| 28. | <i>Menemerus fulvus</i> (L. Koch, 1878) | |
| 29. | <i>Myrmarachne prava</i> (Karsch, 1880) | Ant Mimicking Jumping Spider |
| 30. | <i>Plexippus paykulli</i> Audouin, 1826 | Pantropical Jumping Spider |
| 31. | <i>Phidippus yashodharae</i> Tikader, 1977
Family Sparassidae Bertkau, 1872 | Daring Jumping Spider |
| 32. | <i>Spariolenus megalopis</i> Thorell, 1891 | Huntsman Spiders |
| 33. | <i>Heteropoda venatoria</i> (Linnaeus, 1767) | Giant Crab Spider or The Banana Spider |
| 34. | <i>Olios senilis</i> Simon, 1880
Family Tetragnathidae Menge, 1866 | Huntsman Spiders |
| 35. | <i>Tylorida ventralis</i> Thorell, 1877 | Stretch Spider |
| 36. | <i>Leucauge celebesiana</i> (Walckenaer, 1842) | Orchard Orbweavers |
| 37. | <i>Leucauge pondae</i> Tikader, 1970 | |
| 38. | <i>Leucauge dorsotuberculata</i> Tikader, 1982 | |
| 39. | <i>Leucauge decorata</i> (Blackwall, 1864) | |
| 40. | <i>Tetragnatha andamanensis</i> Tikader, 1977 | Long Jawed Orb Weaver |
| 41. | <i>Tetragnatha bengalensis</i> Walckenaer, 1842
Family Theridiidae Sundevall, 1833 | |
| 42. | <i>Theridion indicum</i> Tikader, 1977 | Comb-footed Spider |
| 43. | <i>Meotipa andamanensis</i> (Tikader, 1977) | Cob web spider |
| 44. | <i>Theridula angula</i> Tikader, 1970
Family Thomisidae Sundevall, 1833 | The Mother's Day Spider |
| 45. | <i>Camarius formosus</i> Thorell, 1887 | Brown flower Spider |
| 46. | <i>Amyciaea forticeps</i> (O. Pickard-Cambridge, 1873) | Ant-Like Crab Spider |
| 47. | <i>Thomisus andamanensis</i> Tikader, 1980
Family Uloboridae Thorell, 1869 | Andaman Flower Spider |
| 48. | <i>Uloborus krishnae</i> Tikader, 1970 | Hackled Orb Weavers |
| 49. | <i>Miagrammopes albomaculatus</i> Thorell, 1891 | One lined eye spider |

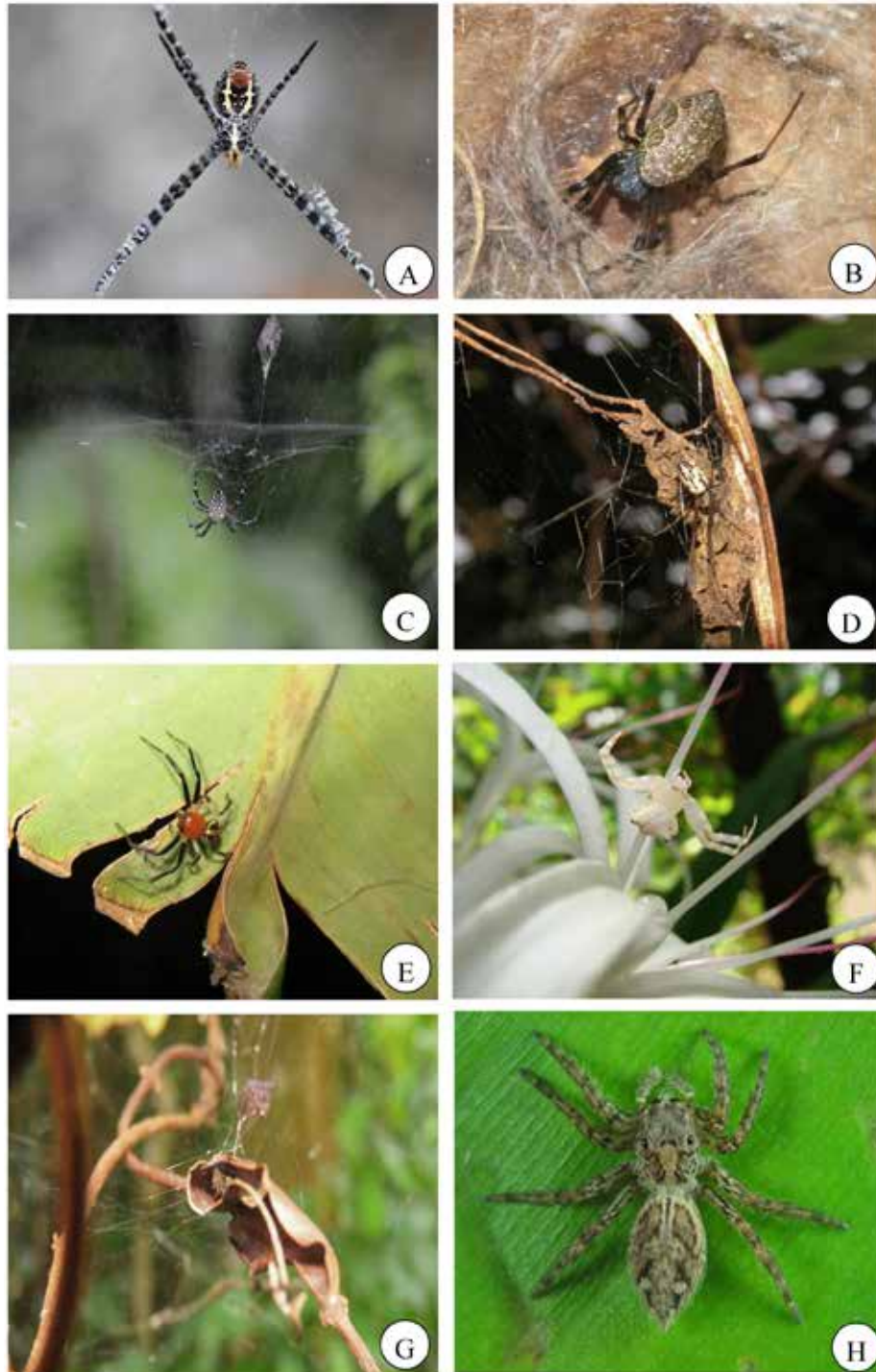


Plate 5. Spiders at the Jarawa Reserved Forests

A Argiope aemula Walckenaer, *B Nephilengys malabarensis* Walckenaer, *C Cyrtophora moluccensis* Doleschall, *D Leucage* sp. Thorell, *E Camaricus formosus* Thorell, *F Thomisus andamanensis* Tikader, *G Theridion indicum* Tikader, *H Plexippus andamanensis* Tikader

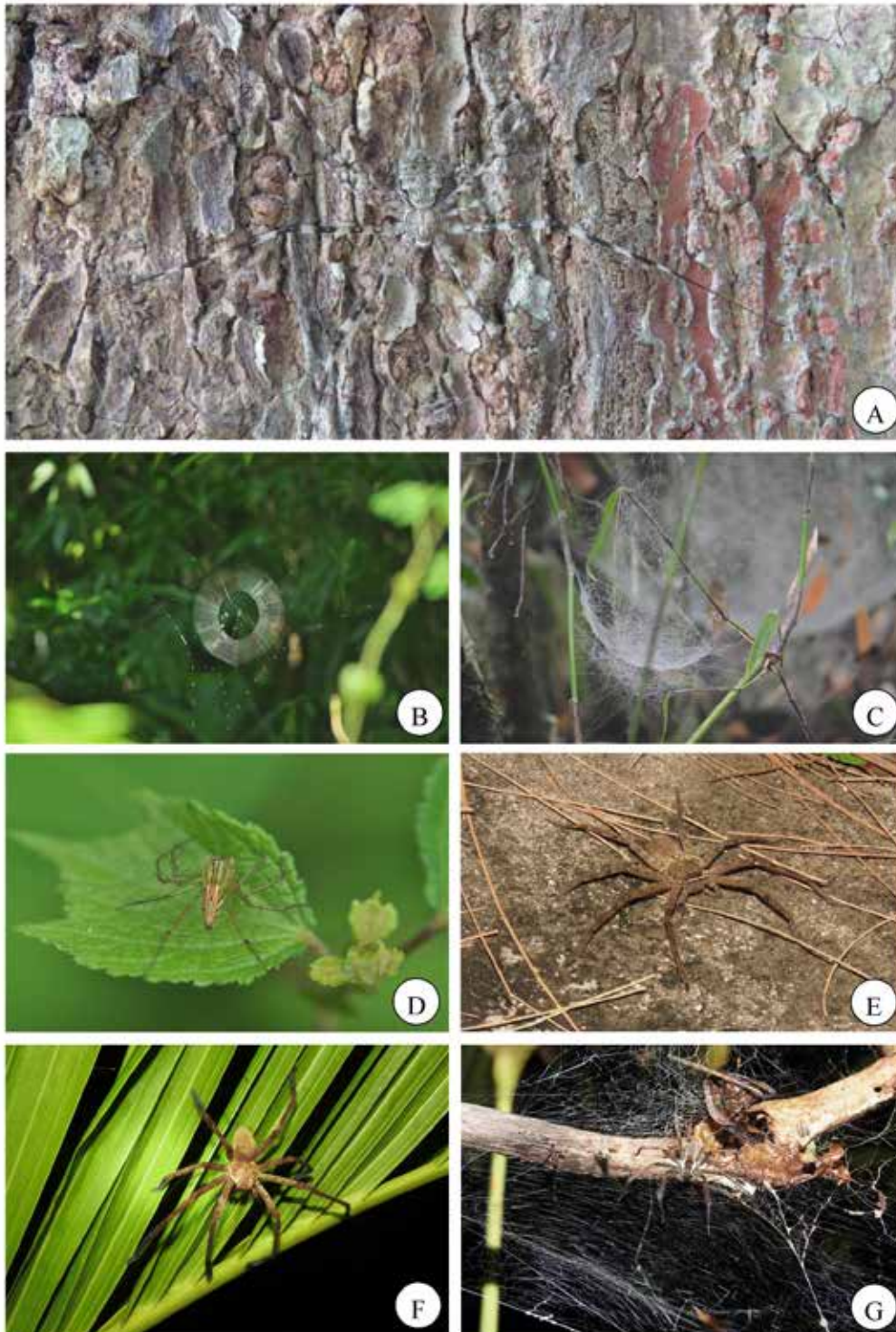


Plate 6. Spiders at the Jarawa Reserved Forests

A *Hersilia* sp. Audouin, *B* *Gasteracantha cuspidata* Koch (Typical web), *C* *Cyrtophora* sp. Thorell (Dome shaped horizontal web), *D* *Oxyopes sunandae* Tikader, *E* *Heteropoda* sp., *F* *Clubiona* sp., *G* *Dendolycosa* sp. (Pseudo orb web) Tikader

Reptiles and Amphibians

A total of 26 species of herpetofauna was identified belonging to 13 family, includes 12 species of snakes,

four species of Gecko, two species of skinks, one species of each lizard, crocodile, water monitor lizard and amphibian (Plates 7 and 8; Table 7).

Table 7. List of reptiles of Jarawa Reserved Forests

Sl. No.	Common name	Species Name	IUCN	WPA (1972)
Order: Crocodilia				
Family: Crocodylidae				
1.	Saltwater Crocodile	<i>Crocodylus porosus</i> Schneider, 1801	LC	I
Order: Squamata				
Family: Gekkonidae				
2.	Andaman giant Gecko ^E	<i>Gekko verreauxi</i> Tytler, 1864	VU	
3.	Andaman bent-toed Gecko ^E	<i>Cyrtodactylus rubidus</i> Blyth, 1860	VU	
4.	Asian house Gecko	<i>Hemidactylus frenatus</i> Dumeril and Bibron, 1836	LC	
5.	Andaman day Gecko ^E	<i>Phelsuma andamanense</i> Blyth, 1860	LC	
Family: Agamidae				
6.	Bay Islands forest Lizard ^E	<i>Coryphophylax subcristatus</i> Blyth, 1860	LC	
Family: Scincidae				
7.	Andaman Islands grass Skink ^E	<i>Eutropis andamanensis</i> Smith, 1935	NE	
8.	Tytler's Mabuya ^E	<i>Eutropis tytleri</i> Theobald, 1868	NE	
Family: Varanidae				
9.	Water monitor Lizard	<i>Varanus salvator andamanensis</i> Deraniyagala, 1944	LC	
Family: Natricinae				
10.	Andaman Keelback Water Snake ^E	<i>Xenochrophis tytleri</i> Blyth, 1863	NE	IV
Family: Colubridae				
11.	Andaman cat Snake ^E	<i>Boiga andamanensis</i> Wall, 1909	NE	IV
12.	Andaman painted bronzeback tree Snake ^E	<i>Dendrelaphis andamanensis</i> Anderson, 1871	NE	IV
13.	Black-tailed Trinket Snake	<i>Coelognathus flavolineatus</i> Schlegel, 1837	LC	IV
14.	Red-tailed trinket Snake	<i>Gonyosoma oxycephalum</i> Boie, 1827	LC	

15.	Andaman Wolf Snake ^E	<i>Lycodon hypsirhinoides</i> Theobald, 1868	NE	IV
16.	Indian Rat Snake	<i>Ptyas mucosa</i> Linnaeus, 1758	NE	IV
Family: Homalopsidae				
17.	Dog-faced Water Snake	<i>Cerberus rynchops</i> Schneider, 1799	LC	II
Family: Elapidae				
18.	Andaman Krait ^E	<i>Bungarus andamanensis</i> Biswas and Sanyal, 1978	VU	IV
19.	Andaman Cobra ^E	<i>Naja sagittifera</i> Wall, 1913	NE	II
20.	King Cobra	<i>Ophiophagus hannah</i> Cantor, 1836	VU	II
Family: Viperidae				
21.	Andaman Pit Viper ^E	<i>Trimeresurus andersoni</i> Theobald, 1868	NE	IV
Order: Anura				
Family: Dicroglossidae				
22.	Andaman Wart Frog ^E	<i>Fejervarya andamanensis</i> Stoliczka, 1870	LC	
23.	Charles Darwin's Frog ^E	<i>Ingerana charlesdarwini</i> Das, 1998	CE	
Family: Microhylidae				
24.	Mayabunder Rice Frog	<i>Microhyla chakrapanii</i> Pillai, 1977	DD	
Family: Bufonidae				
25.	Asian Common Toad	<i>Bufo melanostictus</i> Schneider, 1799	LC	
26.	Andaman Bush Toad ^E	<i>Blythophryne beryet</i> Chandramouli, et al., 2016	NE	

 E - Endemic



Plate 7. Reptiles at the Jarawa Reserved Forests

a Water monitor Lizard, *b* Andaman bent-toed Gecko, *c* Andaman giant Gecko, *d* Indian garden Lizard, *e* Dog-faced Water Snake, *f* Andaman Keelback Water Snake



Plate 8. Amphibians at the Jarawa Reserved Forests

a Asian Bullfrog, *b* Brown Bull Frog, *c* Rice field Frog, *d* Mayabunder Rice Frog, *e* Charles Darwin's Frog, *f* Andaman bush Toad

Birds

Birds are one of the better studied groups of vertebrates and they play an important role in the ecosystem. The Andaman and Nicobar Islands constitute a globally important biodiversity hotspot. Because they are off the mainland and isolated, endemism is very high in all taxa, but especially in reptiles, plants, fish and corals. These

islands are one of the Endemic Bird Areas (Stattersfield *et al.*, 1998). A total of 30 species is restricted in distribution in the Islands of which, 21 species are reported from the Andaman group of Islands and 9 species are reported from the Nicobar group. Total of 75 species of birds under 31 families were recorded from the study area (Table 8) and photographs are illustrated in Plates 9 and 10.

Table 8. List of bird's species recorded from the Jarawa Reserved Forests

Sl. No.	Common name	Scientific Name	Residential	IUCN	IWPA, 1972
Pelecaniformes					
Pelecanidae					
1.	Little Egret	<i>Egretta garzetta</i> Linnaeus, 1766	R/LM	LC	IV
2.	Pacific Reef-Egret	<i>Egretta sacra</i> Gmelin, 1766	R	LC	IV
3.	Great Egret	<i>Egretta alba</i> Linnaeus, 1758	R/LM	LC	IV
4.	Intermediate Egret	<i>Egretta intermedia</i> Wagler, 1829	R/WM	LC	IV
5.	Eastern Cattle Egret	<i>Bubulcus coromandus</i> Boddaert, 1783	R/LM	LC	IV
6.	Chinese Pond-Heron	<i>Ardeola bacchus</i> Bonaparte, 1855	WM	LC	IV
7.	Andaman Striated Heron ^{ENS}	<i>Butorides striatus spodiogaster</i> Sharpe, 1894	R	NE	IV
8.	Malayan Night-Heron ^{ENS}	<i>Gorachius melanolophus minor</i> Hachisuka, 1926	R	DD	IV
Anseriformes					
Anatidae					
9.	Andaman Teal ^E	<i>Anas albogularis</i> Muller, 1842	R	NT	I
Accipitriformes					
Accipitridae					
10.	White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i> Gmelin, 1788	R	LC	I
11.	Andaman Serpent-Eagle ^E	<i>Spilornis elgini</i> Blyth, 1863	R	NT	
12.	Crested Serpent-Eagle ^{ENS}	<i>Spilornis cheela davisoni</i> Hume, 1873	R	NE	
13.	Changeable Hawk-Eagle ^{ENS}	<i>Nisaetus limnaetus andamanensis</i> Tytler, 1865	R	NE	
Gruiformes					
Rallidae					
14.	Andaman Crake ^E	<i>Rallina canningi</i> Blyth, 1863	R	NT	IV
15.	Blue-Breasted Rail ^{ENS}	<i>Gallirallus striatus obscurior</i> Hume, 1874	R	NE	IV
16.	White-breasted Waterhen ^{ENS}	<i>Amaurornis phoenicurus insularis</i> Sharpe, 1894	R	NE	IV
17.	Common Moorhen	<i>Gallinula chloropus</i> Linnaeus, 1758	R	LC	IV
Charadriiformes					
Charadriidae					
18.	Pacific Golden-Plover	<i>Pluvialis fulva</i> Gmelin, 1789	WM	LC	IV

Scolopacidae					
19.	Eurasian Whimbrel	<i>Numenius phaeopus</i> Linnaeus, 1758	WM	LC	IV
20.	Common Redshank	<i>Tringa totanus</i> Linnaeus, 1758	WM	LC	IV
21.	Common Sandpiper	<i>Actitis hypoleucos</i> Linnaeus, 1758	WM	LC	IV
Burhinidae					
22.	Beach thick-Knee	<i>Esacus magnirostris</i> Vieillot, 1818	R	NT	
Laridae					
23.	Black-naped Tern	<i>Sterna sumatrana</i> Raffles, 1822	R/LM	LC	IV
Columbiformes					
Columbidae					
24.	Blue-rock Pigeon ^{IN}	<i>Columba livia</i> Gmelin, 1789	R	LC	
25.	Andaman Wood-Pigeon ^E	<i>Columba palumboides</i> Hume, 1873	R	NT	IV
26.	Red Collared-Dove	<i>Streptopelia tranquebarica</i> Hermann, 1804	R	LC	IV
27.	Andaman Cuckoo-Dove ^E	<i>Macropygia rufipennis</i> Blyth, 1846	R	NT	IV
28.	Andaman Emerald Dove ^{ENS}	<i>Chalcophaps indica maxima</i> Hartert, 1931	R	LC	IV
29.	Andaman Green-Pigeon ^E	<i>Treron chloropterus</i> Blyth, 1840	R	NT	IV
30.	Green-Imperial Pigeon ^{ENS}	<i>Ducula aenea andamanica</i> Abdualali, 19 64	R	LC	IV
Psittaciformes					
Psittaculidae					
31.	Vernal Hanging-Parrot	<i>Loriculus vernalis</i> Sparman, 1787	R	LC	
32.	Alexandrine Parakeet ^{ENS}	<i>Psittacula eupatria magnirostris</i> Ball, 1872	R	NT	IV
33.	Red-breasted Parakeet ^{ENS}	<i>Psittacula alexandri abbotti</i> Oberholser, 1919	R	NT	IV
34.	Red-Cheeked Parakeet ^{ENS}	<i>Psittacula longicauda tytleri</i> Hume, 1874	R	NT	IV
Cuculiformes					
Cuculidae					
35.	Indian Cuckoo	<i>Cuculus micropterus</i> Gould, 1837	R	LC	IV
36.	Asian Koel ^{ENS}	<i>Eudynamys scolopacea dolosus</i> Ripley, 1946	WM	LC	IV
37.	Andaman Coucal ^E	<i>Centropus andamanensis</i> Beavan, 1867	R	LC	IV
Strigiformes					
Strigidae					
38.	Andaman Scops-Owl ^E	<i>Otus balli</i> Hume, 1873	R	NT	IV
39.	Oriental Scops-Owl ^{ENS}	<i>Otus sunia modestus</i> Walden, 1874	R	LC	IV
40.	Andaman Hume's Boobook ^E	<i>Ninox obscura</i> Hume, 1872	R	LC	IV
41.	Andaman Boobook ^E	<i>Ninox affinis</i> Beavan, 1867	R	NT	IV
Caprimulgiformes					
Apodidae					

42.	White-bellied Swiftlet ^{ENS}	<i>Collocalia esculenta affinis</i> Beavan 1867	R	LC	
Coraciiformes					
Alcedinidae					
43.	Common Kingfisher	<i>Alcedo atthis</i> Linnaeus, 1758	WM	LC	IV
44.	Stork-billed Kingfisher ^{ENS}	<i>Pelargopsis capensis osmastoni</i> Baker, 1934	R	NE	IV
45.	White-throated Kingfisher ^{ENS}	<i>Halcyon smyrnensis saturator</i> Hume, 1874	R	LC	IV
46.	Collared Kingfisher ^{ENS}	<i>Todiramphus chloris davisoni</i> Sharpe, 1892	R	NE	IV
Meropidae					
47.	Chestnut headed Bee-eater ^{ENS}	<i>Merops leschenaulti andamanensis</i> Marien, 1950	R	LC	
Coraciidae					
48.	Andaman Dollarbird ^{ENS}	<i>Eurystomus orientalis gigas</i> Stesemann, 1913	R	LC	IV
Piciformes					
Picidae					
49.	Andaman Spot-breasted Woodpecker ^{ENS}	<i>Dendrocopos analis andamanensis</i> Blyth, 1859	R	LC	IV
50.	Andaman Woodpecker ^E	<i>Dryocopus hodgei</i> Blyth, 1860	R	NT	IV
Passeriformes					
Campephagidae					
51.	Andaman Large Cuckoo-Shrike ^{ENS}	<i>Coracina macei andamanensis</i> Whistler, 1940	R	LC	
52.	Small Minivet	<i>Pericrocotus cinnamomeus</i> Linnaeus, 1776	R	LC	IV
53.	Andaman Scarlet Minivet ^{ENS}	<i>Pericrocotus speciosus andamanensis</i> Beavan, 1867	R	LC	IV
Pycnonotidae					
54.	Andaman Bulbul ^E	<i>Microtarsus fuscoflavescens</i> Hume, 1875	R	LC	IV
55.	Red-whiskered Bulbul ^{ENS}	<i>Pycnonotus jocosus whistleri</i> Deignan, 1948	R	NE	IV
Irenidae					
56.	Andaman Asian Fairy-Bluebird ^{ENS}	<i>Irena puella andamanica</i> Abdulali, 1964	R	LC	IV
Laniidae					
57.	Brown Shrike	<i>Lanius cristatus</i> Linnaeus, 1758	WM	LC	
Turdidae					
58.	Orange-headed Thrush ^{ENS}	<i>Geokichla citrina andamanensis</i> Walden, 1874	R	LC	IV
Muscicapidae					
59.	Oriental Magpie-Robin ^{ENS}	<i>Copsychus saularis andamanensis</i> Hume, 1874	R	LC	

60.	Andaman Shama ^E	<i>Copsychus albiventris</i> Blyth, 1858	R	LC	
	Monarchidae				
61.	Andaman Black-naped Monarch-Flycatcher ^{ENS}	<i>Hypothymis azurea tytleri</i> Beavan, 1867	R	NE	
	Dicaeidae				
62.	Andaman Flowerpecker ^E	<i>Dicaeum virescens</i> Hume, 1873	R	LC	IV
	Nectariniidae				
63.	Olive-backed Sunbird ^{ENS}	<i>Cinnyris jugularis andamanicus</i> Hume, 1873	R	LC	IV
	Zosteropidae				
64.	Oriental White-eye	<i>Zosterops palpebrosus</i> Temminck, 1824	R	LC	IV
	Estrildidae				
65.	White rumped Munia ^{ENS}	<i>Lonchura striata fumigata</i> Waldeen, 1873	R	LC	IV
	Sturnidae				
66.	Andaman Glossy Starling ^{ENS}	<i>Aplonis panayensis tytleri</i> Hume, 1873	R/LM	LC	IV
67.	Andaman White-headed Starling ^E	<i>Sturnia erythropygia</i> Blyth, 1846	R	LC	IV
68.	Common Myna ^{IN}	<i>Acridotheres tristis</i> Linnaeus, 1766	R	LC	IV
69.	Hill Myna ^{ENS}	<i>Gracula religiosa andamanensis</i> Beavan, 1867	R	NT	IV
	Oriolidae				
70.	Black-naped Oriole ^{ENS}	<i>Oriolus chinensis andamansis</i> (Tytler, 1867)	R	LC	IV
71.	Black-hooded Oriole ^{ENS}	<i>Oriolus xanthornus eubeni</i> Abdulali, 1977	R/LM	LC	IV
	Dicruridae				
72.	Andaman Drongo ^E	<i>Dicrurus andamanensis</i> Beavan, 1867	R	NT	IV
73.	Racket-tailed Drongo ^{ENS}	<i>Dicrurus paradiseus otiosus</i> Richmond, 1903	R	LC	IV
	Corvidae				
74.	Andaman Treepie ^E	<i>Dendrocitta bayleyi</i> Blyth, 1863	R	NT	
75.	Eastern Jungle Crow	<i>Corvus levaillantii</i> Lesson, 1831	R	LC	

Residential Status: **R** Resident; **R/LM** Resident with local movements; **R/WM** Resident with winter Migrant; **WM** Winter Migrant; **WM/PM** Winter migrant as well as passage migrant; **PM** Passage migrant; **PM/SM** Passage migrant with summer Migrant; **PM/WM** Passage migrant with winter movements; **SM** Summer migrant; **SM/R** Summer migrant with resident; **S** Straggler and **V** Vagrant (Ali & Ripley, 1983; Tikader, 1984; Grimmett et al., 2008; Kazmierczak & van Perlo, 2000;

Kumar et al., 2005; Rasmussen & Anderton, 2012)

IUCN Status: **LC** Least Concern; **NT** Near Threatened; **EN** Endangered; **VU** Vulnerable; **NE** Not Evaluated; **DD** Data Deficient (BirdLife International, 2015)



Plate 9. Avifauna at the Jarawa Reserved Forests

A Little Egret, *B* Eurasian Whimbrel, *C* Andaman Coucal, *D* Oriental Scops-Owl, *E* Ruddy Kingfisher, *F* Eastern Jungle Crow



Plate 10. Avifauna at the Jarawa Reserved Forests

a Striated Heron, *b* White-breasted Waterhen, *c* Violet Cuckoo, *d* Red Collared-Dove, *e* Andaman Scops Owl, *f* Stork-billed Kingfisher
Traditional name of birds

This study revealed that Jarawas have the vernacular name for birds. 52 species of avifauna with local and Jarawa vernacular names are given in (Table 9).

Table 9. Knowledge of bird resource use among Jarawa Tribe of Andaman Islands

Sl. No.	Common Name	Local Name	In Jarawa Terms
1.	Andaman Teal	Jungli Batak	Maiin tantumaiin main
2.	Pacific Reef-Egret	Bagula	Hudhbhai
3.	Andaman Straited Heron		Hirungaan
4.	Brahminy Kite	Brahmini cheel, Shankha cheel;	Totaho
5.	Sparrow Hawk	Basha, Bashin	Konokano
6.	Andaman Serpent-Eagle	Cheel	Kuchk, Kuchak
7.	White-bellied Sea-Eagle	Kohassa	Vannallank
8.	White-breasted Waterhen	Jungli murgha	Odola
9.	Andaman Crake	Jungli murgha	Nadak
10.	Small Waders		Torkono
11.	Whimbrel	Chhota, Goungh, Chhota Kuthirai malai Kottan	Chianbutalu
12.	Plover		Honkonhon
13.	Beach thick-Knee		Digli
14.	Terns	Nicobar: Sanna yena	Tichegedu
15.	Green-Imperial Pigeon	Kabutar	Aaun
16.	Andaman Wood-Pigeon	Kabutar	Odeyahey
17.	Andaman Cuckoo-Dove	Biki	Waho
18.	Emerald Dove	Biki	Muduho
19.	Andaman Green-Pigeon	Hariyaal	Yoha
20.	Vernal Hanging-Parrot	Latkan totha	Yagya
21.	Parakeets		Ukjha
22.	Cuckoo	Hor kuk, Shakuk	Cuckou
23.	Asian Koel	Koel	
24.	Owl		Bong
25.	Andaman Coucal	Khana kawa	Thehbabuh
26.	Andaman Nightjar		Bhodale
27.	Swiftlet		Billa
28.	Kingfisher	Kilkila, Kourilla	Tiinktan
29.	Stork-Billed Kingfisher		Haekel
30.	Blue-eared Kingfisher		Bay bay
31.	Ruddy Kingfisher		Chamcha
32.	Common Sandpiper		Thoragey
33.	Purple Moorhen		Mundughar
34.	Bee-eater	Bada patringa	Peybey
35.	Spot-breasted Woodpecker		Dholaly
36.	Andaman Woodpecker		Oley
37.	Andaman Cuckoo-Shrike	Kasya, Sanskrit	Tepugidhu
38.	Minivet		Golo
39.	Andaman Bulbul	Bulbul	Nodidede
40.	Red-whiskered Bulbul	Pahari bulbul, Kamera bulbul	Bejelek

41.	Dollarbird		Thahad
42.	Asian Fairy-Bluebird	Lalita	Nohailungta
43.	Orange-headed Thrush	Dama	Bebe
44.	Oriental Magpie-Robin		Tohthe
45.	Andaman Shama		Tohthe
46.	Black-naped Oriole	Macheon	Kolo
47.	Racket-tailed Drongo	Bhimraj, Bhringrajn	Vithal
48.	Andaman Drongo		Vithal
48.	Hill Myna	Chalik Myna	Tugajaye
49.	Eastern Jungle Crow	Kala kowwa	Wara
50.	Andaman Flower Pecker		Nodidede

Mammals

(Table 10). Mammal species recorded during the study period from Tirur and Jirkatang areas is shown in Plate 11.

A total of six species of mammals distributed among 6 genera and 5 families were recorded from these areas

Table 10. List of Mammals of Jarawa Reserved Forests

Sl. No.	Common Name	Species Name	IUCN Status	Endemic	WPA
	Order: Chiroptera				
	Family: Pteropodidae				
1.	Indian Flying Fox	<i>Pteropus giganteus</i> Brunnich, 1782	LC	E	
2.	Lesser Short-nosed Fruit Bat	<i>Cynopterus brachyotis brachysoma</i> Dobson, 1871	LC		
	Family: Rhinolophidae				
3.	Andaman Horseshoe Bat	<i>Rhinolophus cognatus</i> Andersen, 1906	EN	E	
	Order: Carnivora;				
	Family: Viverridae				
4.	Andaman Masked Palm Civet	<i>Paguma larvata tytleri</i> Tytleri, 1864	LC	E	II
	Order: Cetartiodactyla Family:				
	Cervidae				
5.	Chital	<i>Axis axis</i> Erxleben, 1777	LC		III
	Order: Cetartiodactyla Family:				
	Suidae				
6.	Andaman Wild Pig	<i>Sus scrofa andamanensis</i> Blyth, 1858	LC	E	I



Plate 11. Mammals at the Jarawa Reserved Forests

A Indian Flying Fox *Pteropus giganteus* Brunnich, **B** Lesser Bamboo Bat *Tylonycteris pachypus* Temminck, **C** Andaman Wild Boar *Sus scrofa andamanensis* Blyth, **D** Northern Red Muntjak *Muntiacus vaginalis* Boddaert

Indigenous Knowledge

This study revealed, that the Jarawas use the whole meat / fat of Andaman Wild Boar and Water Monitor

Lizard for traditional medicines. While they directly consume honey bee as food and as medicines (Table 11).

Table 11. Knowledge of animal resources used by Jarawa tribe of Andaman Islands

Sl. No.	Common Name	Local name	Vernacular Name	Parts used	Traditional Uses	Mode of Preparation
1.	Andaman Wild Boar	Jungli Suvar	Hawva	Whole body meat and Fat	Food & Medicinal uses Fat (Alam) is used for Stomach Pain, Body Pain, Joint pain, Headache and Toothache.	Food: Burn; skin is removed and it is boiled sometimes with salt. Medicinal (Alam): fresh water algae are heated and crushed to powder and then mixed with fat oil, then stored for 2–3 days.
2.	Andaman Palm Civet Cat	Jungli Billi	Ohm	Whole body flesh	Food	Boil
3.	Water Monitor Lizard	Goei	Orub	Whole body flesh	Food; Medicinal (Fat oil) Body pain.	Boil
4.	Sea Turtle	Kachuwa	Ugalae	Whole body flesh	Food	Boil
5.	Sting ray	Shanker Machi	Alau	Flesh	Food	Remove Sting and Boil
6.	Shark	Badmas Machi	Aadhu	Flesh	Food	Boil
7.	Salt Water Mussel	Seepi	Waag	Flesh	Food	Boil
8.	Crabs	Kekda	Haga	Flesh	Food	Boil
9.	Prawn	Jhinga	Ahao	Flesh	Food	Boil/Fry
10.	Honey bee	Shehed	Leo	Honey	Food; Medicinal-Fever	Direct consumption
11.	Insects	Keeda	Tayata			
12.	Mosquito	Macchar	Uinank			
13.	Ants	Cheeti	Jajaba			
14.	Cicada		Deva	Whole body	For fun	Tie with rope in hand
15.	Butterfly	Titli	Parigao	Whole body	Bad omen before hunting, get confused	
16.	Moth	Titli	Batbeil	Whole body		
17.	Beetle (Grub)		Ono	Whole Body	Food	Boil
18.	Frog	Mendak	Etal			

Conclusion

About 476 million indigenous communities live in over 90 countries across the world. There is a tremendous diversification among these aboriginal communities, each of which has its own distinct culture, language, history, and unique way of life. Despite such individualities they share certain common ethnic values. The Jarawa tribe belonging to the Negrito stock is continuing with its hunting and gathering way of life and at present on this tribe inhabits the west coast the South and Middle Andaman Islands. This study shows that like most ethnic and isolated foragers possess huge repertoire of the indigenous knowledge regarding the use of different animals and plants in traditional medicine and such ethnosience is passed on from one generation to another as an oral tradition. Due to impact of modern

communities, this indigenous knowledge is being lost for ever unless it is documented urgently. The present study revealed 18 species of animals and 26 plants are used in 25 different bio-therapeutic medicinal purposes, including acidity, cold, cough, diarrhoea, dehydration, vomiting, food poisoning, fever, joint pain, leg sprain, bone fracture, coagulant, hair growth, paralysis, body ache, ear & eye pain, stomach pain, toothache, jaundice, weakness, wound, insect bite, labour pain, menstrual hygiene, and for other purposes. It was observed that 26 species of plants and 3 species of animals are used by the Jarawas in their traditional medicine. Besides, this study documented 81 species and subspecies of butterflies, 9 species of Odonata and 41 species of Moths, 49 species of spiders, 26 species of herpetofauna, 75 species of avifauna, and 7 species of mammals from the Jarawa Reserved Forest of South Andaman Island. Among

reported fauna, 11 animals such as Andaman Wild Boar, Andaman Palm Civet Cat, Water Monitor Lizard, Sea Turtle, Stingray, Shark, Saltwater Mussel, Crabs, Prawn, Honeybee, Beetle (Grub) are used for food while, the butterfly is considered as a bad omen and Cicada is used for fun by these tribal communities. The protected species such as *Sus scrofa andamanensis* (Andaman wild boar) is used to in treating the stomach pain, body pain, joint pain, headache, and toothache by these tribal communities. The paperwork of this indigenous knowledge on plant and animal-based medicines will be guidelines for sustainable management and conservation of bio-resources as well as offering potential for novel drug discovery.

Acknowledgements

We are grateful to the Director, Zoological Survey of India, Ministry of Environment, Forest and Climate Change, Govt. of India, Kolkata for providing necessary facilities to Zoological Survey of India, Port Blair to undertake the study. The Principal Chief Conservator of Forests and PCCF (WL), Department of Environment and Forests, Andaman and Nicobar Administration for extending logistic support to conduct the survey. The Bisweswar Das, Tribal Welfare Officer, Andaman Adim Janjati Vikas Samiti (AAJVS) and AAJVS staffs for their immense support. Jarawa Protection Police of Tirur and Jirkatang Post, for providing necessary facilities and protection to undertake the study. Shri. Anjale and other Jarawas of Tirur and Jirkatang (Middle Strait) for giving animal vernacular names.

References

- Ali, S. & Ripley, S.D. 1983. Handbook of the birds of India and Pakistan. Compact Edition. New Delhi: Oxford University Press.
- Bonebrake, T.C., Ponisio, L.C., Boggs, C.L. & Ehrlich, P.R. 2010. More than just indicators: A review of tropical butterfly ecology and conservation. *Biol. Conserv.* 143(8): 1831-1841.
- Boulenger, G.A. 1890. Fauna of British India Including Ceylon and Burma. Reptilia and Batrachia London. London: Taylor and Francis.
- Burnham, K.P., Anderson, D.R. & Laake, J.L. 1980. Estimation of density from line transect sampling of biological populations. *Wildl. Monogr.* 72: 1–202.
- Champion, H.G. & Seth, S.K. 1968. A Revised Forest Types of India. Manager of Publications, Government of India, Delhi.
- Daniel, J.C. 1963. Field Guide to the Amphibian of Western India. *Journal of Bombay Natural History Society* 60: 415–438.
- Davidar, P., Devi, S.M., Yoganand, T.R.K. & Ganesh, T. 1995. Reserve size and implications for the conservation of biodiversity in the Andaman Islands. In: Boyle, T.J.B., and Boontawee, B., (Eds.) Measuring and monitoring biodiversity in tropical and temperate forests. Indonesia: CIFOR.
- Devy, M.S., Ganesh, T. & Davidar, P. 1994. A preliminary survey of the butterflies on some Islands in the Andamans. *Journal of Andaman Science Association*, 10, 50–56.
- Devy, M.S., Ganesh, T. & Davidar, P. 1994. A preliminary survey of the butterflies on some islands in the Andamans. *J. Andaman Sci. Assoc.* 10: 50–56.
- FSI 2019. Indian State Forest Report 2019. Forest Survey of India, Dehra Dun.
- Grimmett, R., Inskipp, C. & Inskipp, T. 1998. Birds of the Indian Subcontinent. Delhi: Oxford University Press.
- Grimmett, R., Inskipp, C. & Inskipp, T. 2008. Pocket Guide to the Birds of the Indian Subcontinent. Christopher Helm, London, 384 p.
- Jayaraj, R.S.C. & Andrews, H.V. 2005. Andaman & Nicobar Islands Union Territory biodiversity strategy and action plan, 142 p. India: Prepared under the National Biodiversity Strategy and Action Plan-India, ANET/GOI/UNDP/A&N Department of Environment and Forests.
- Kazmierczak, K. & van Perlo, B. 2000. A field guide to the birds of India, Sri Lanka, Pakistan, Nepal, Bhutan, Bangladesh and the Maldives. Sussex: Pica Press. 352 p
- Kehimkar, I. 2016. Butterflies of India. Mumbai: Bombay Natural History Society, 505 pp.
- Kingsley, R. 1999. The Spiders. New Star Standard Industries (Pvt) Ltd., Singapore, 1-34.

- Klorvuttimontara, S., McClean, C.J. & Hill, J.K. 2011. Evaluating the effectiveness of protected areas for conserving tropical forest butterflies of Thailand. *Biol Conserv.* 144: 2534-2540
- Kocher, S.D. & Williams, E.H. 2000. The diversity and abundance of North American butterflies vary with habitat disturbance and geography. *J. Biogeogr.* 27(4): 785-794.
- Matthews, T. J., H. E. Cottee-Jones, & R. J. Whittaker. 2014. Habitat fragmentation and the species– area relationship: a focus on total species richness obscures the impact of habitat loss on habitat specialists. *Diversity and Distributions* 20:1136–1146.
- Nieuwenhuys, A. 2008. Spider Information. <http://ednieuw.home.xs4all.nl/Spiders>
- Novak, K. 2001. Spider venom helps hearts keep their rhythm. *Nat. Medic.* 3: 25-26.
- Platnick, N. 1995. An abundance of spiders. *Nat. Hist. Mus. USA.*, 104: 50-53.
- Platnick, N.I., & C. Ewing. 1995. A revision of the tracheline spiders (Araneae, Corinnidae) of southern South America. *Am. Mus. Novitates* 3128: 1–112.
- Pollard, E. 1977. A method for assessing changes in the abundance of butterflies. *Biol. Conserv.* 12: 115–134.
- Pollard, E. & Yates, T.J. 1993. Monitoring butterflies for ecology and conservation. The British butterfly monitoring scheme. Institute of Terrestrial Ecology and Joint Nature Conservation Committee. London: Chapman and Hall, 274 p.
- Radcliffe Brown, A.R. 1922. The Andaman Islanders. Glencoe, Illinois: The Free Press.
- Rajasingh, V.R. 2002. Structure of the Jarawa Language. In: Mukhopadhyay, K. *et al.* (Ed) Jarawa Contact: ours with them, theirs with us. Kolkata: Anthropological Survey of India.
- Rasmussen, P.C. & Anderton, J.C. 2012. Birds of South Asia: The Ripley guide. 2nd ed. Washington, D.C. and Barcelona: Smithsonian Institution and Lynx Editions. 2 Vols. pp. 1-378.
- Rodgers, W.A. 1991. Techniques for Wildlife Census in India - A Field Manual, Technical Manual: TM-2. Dehra Dun: Wildlife Institute of India, 82 pp.
- Shubhalaxmi, V. 2018. Field Guide to Indian Moths, 1st Edn. India: Birdwing publisher, 461 p.
- Sivaperuman, C. & K. Venkataraman 2012. Diversity of Butterflies in Ritchie’s Archipelago, Andaman and Nicobar Islands. pp. 159-176. In: Ecology of faunal communities on the Andaman and Nicobar Islands. (Eds.) K. Venkataraman, C. Raghunathan and C. Sivaperuman. Springer-Verlag Berlin Heidelberg.
- Sivaperuman, C., M.C. Patel, J. Dinesh & G. Gokulakrishnan 2014. Diversity and distribution of Butterflies in North Andaman. *Ann. For.* 22(2): 223-243.
- Smith, M.A. 1933. The Fauna of British India Including Ceylon and Burma. Reptilia and Amphibia, Vol. I. *Loricata Testudiens*. London: Taylor and Francis.
- Smith, M.A. 1935. The Fauna of British India Including Ceylon and Burma. Reptilia and Amphibia, Vol. II. Sauria. London: Taylor and Francis.
- Smith, M.A. 1943. The Fauna of British India Including Ceylon and Burma. Reptilia and Amphibia, Vol. III. London: Taylor and Francis.
- Stattersfield, A.J., Crosby, M.J., Long, A.J. & Wege, D.C. 1998. Endemic Bird Areas of the World. Cambridge: BirdLife International.
- Thomas, J.A. 2005. Monitoring change in the abundance and distribution of insects using butterflies and other indicator groups. *Philosophical Transactions of the Royal Society B*, 360, 339–357.
- Tikader, B.K. 1984. Birds of Andaman & Nicobar Islands. Calcutta: Zoological Survey of India.
- van Nieukerken, E.J., Kaila, L., Kitching, I.J., Kristensen, N.P., Lees, D.C. & Minet, J. 2011. Order Lepidoptera Linnaeus, 1758. In: Zhang, Z.-Q. (Ed.) Animal Biodiversity: An Outline of Higher-level Classification and Survey of Taxonomic Richness. *Zootaxa*, 3148: 212–221.