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New records of butterflies and authentication of several species of butterflies existence in Assam

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ABSTRACT

Maim aim and objectives of the paper was to documented the new records of butterflies in the state of Assam based on intensive field survey from 2000 to 2014 and highlight the past distribution records of Assam for the butterflies field workers of the state and as well as across the globe. The present paper deals with the new reports of butterflies and corrected distribution records of Assam's butterflies is a part of butterflies studies done by the authors that have covered the north and south bank landscape of Assam including the areas of Manas National Parks, Nameri National Park, Chandubi RF, Rani- Garbhanga RF, Gauhati University Campus, Jalukbari, Gibbon Wildlife Sanctuary, part of Dihing Patkai WLS and Jeypore RF, Namrup RF etc. The present findings of new records of butterflies from Assam were not documented by past authors from Assam and the corrected distribution records of butterflies species that have been written erroneously by Kehimkar in his recently published book. Altogether three new records of butterflies species have been made in Assam recently those were viz., Indo-Chinese Tricolor Pied Flat-*Coladenia indrani uposathra*, Chocolate Grass Yellow: *Eurema sari sodalis* and Khasi Hill Common Earl-*Tanaecia julii khasiana* and one new larval host-plant species (that was not reported by any workers in Past) of Red Spot Jezabel-*Dalias discombasi discombasi* and life history parts. Again**,** altogether 53 butterflies species distribution records have been made in Assam during survey periods from 2000-2014 from the study sites that have not been documented by Kehimkar in his recently published literature. It is worth mentioning to note that, the distribution records of those 53 butterflies in Assam were although not clearly described with their specific sighting locations by the past workers, but it should be cited by the Kehimkar in his recent book. Thus, the present report has clarified the status of the butterflies from the state of Assam. It is a very important piece of work that has been emphasized to documentation of butterflies correct distribution records by the future butterfly workers. The reporting of butterflies were such as Papilionidae, 15, species, Nymphalidae, 20, species, Pieridae, 4, species, Lycaenidae, 13, species and Hesperiidae only 1 species in the study area.

Key Words: New records, Butterflies, Authentication, Documentation, Assam, distribution records, corrected distribution.

INTRODUCTION

Northeast India, the parts of Eastern Himalayas, is one of the most important hotspot of biological diversity including butterflies. More than 85% of butterfly species that occur in the Indian 'sub-continent' & Myanmar are harbored in this region. The great diversity of plants, habitats and topography are the major influences on the butterflies distribution, diversity and abundance in Eastern Himalayan region (Mani, 1986). Again, the butterflies, besides being recognized as important resources in aesthetics, educational and environmental investigations are now considered as ecological and environmental indicators (Gunathilagoraj *et al.*, 1997).

Few scientists in Northeastern region had studied on the butterfly species diversity, species composition and its distribution patterns. Talbot (1939, 1947) and Evans (1912, 1932) had completed the taxonomy and identification of the butterflies in northeastern region and its adjoining areas during early parts of the twentieth century. However, Gupta & Sukla (1988) have studied the distribution and taxonomy of *Nympahlidae* and *Lycaenidae* butterflies in Arunachal Pradesh and its adjoining areas. Bhattacharjee (1985a, 1985b) has also studied the taxonomy and distribution of *Nymphalidae*, *Pieridae* and *Lycaenidae* butterflies in northeastern region of India during last parts of the twentieth century. However, most of the butterflies information was based on the butterflies specimens collections of past workers. Betts (1950) had studied butterfly diversity in the northern bank of Brahmaputra River, starting from earlier Balipara Frontier Tract (now Chariduar and Balipara of Assam), from Bhalukpung to Tawang and Subansiri district of Arunachal Pradesh. Varsiiney & Chandra (1971) have compiled the butterflies reports of northeastern region covering the area of (1) Kameng Frontier Division, Tirap Frontier Division, Siang Frontier Division of Arunachal Pradesh, (2) Golaghat, Kaziranga, Garampani, Guwahati and Phulbari of Assam, (3) Tura, Shillong, Cherrapunji, Kolosib of Meghalaya and (4) Aizawl of Mizoram state of Northeast India from the Museum specimen collected during 1959-1969. Several workers during British period also had been studied the butterfly diversity in Northeastern region, of which, the works of Butler (1879), Marshall & DE Niceville (1882), Wood-Mason (1882), De Niceville (1886), Wood-Mason & DE Niceville (1887), Doherty (1889), Elwes (1891), Watson (1891), Swinhoe (1893, 1910-1913), Fawcett (1904), Tytler (1911, 1914), Watkins (1927) and Cantlie (1952) were worth mentioning. However, very less recent published articles are available on the total inventory of butterflies covering all the important ecological pockets of Assam except Saikia (2011, 2012, 2014),Saikia and Saikia (2014), Saikia *et al.* (2010a), Saikia *et al.*, (2010b), Saikia *et al*. (2009), Saikia *et al.* (2007), Saikia and Saikia (2006)and Saikia *et al.* (2005) etc.

The present article on the new report of butterflies and corrected distribution records of Assam is a part of butterflies studies done by the authors that have covered the north and south bank landscape of Assam including the areas of Manas National Parks (Saikia and Saikia, 2006, 2014), Chandubi RF (Saikia, 2011), Rani- Garbhanga RF (Saikia *et al*., 2009, 2010a), Gauhati University Campus, Jalukbari (Saikia *et al*., 2007; Saikia, 2014), Gibbon Wildlife Sanctuary, part of Dihing Patkai WLS and Jeypore RF, Namrup RF etc. The present paper emphasized only new records of butterflies from Assam those distribution records were not mentioned by the past author from Assam (Evans, 1932; Talbot, 1939) and also corrected distribution records of butterflies species that have been written erroneously by the authors in his published documents (Kehimkar, 2008). Main aim and objectives of the present paper was to documented new records of butterflies in the state of Assam based on intensive field survey from 2000 to 2014 and highlighted the past distribution records of Assam for the butterflies field workers of the state and as well as across the globe.

STUDY AREA

Manas

The investigations were carried out in the Core area of Manas Biosphere Reserve (MBR) in the state of Assam in Northeast India, located within the latitude of 25°45'- 26°50' N and Longitude 90° 30' – 91° 26' E, situated in the north bank of river Brahmaputra and about 200 km north of Guwahati City. The northern boundary of MBR is the common international boundary of the Bhutan Himalayas. The study area of MBR is a foothill of lower Himalayas and undulating in the northern boundary and then gradually merging into low lying flat plain on the southern side. The Manas river is the largest Himalayan tributary of the river Brahmaputra flowing from the northeastern to western boundary of the present study area. Tropical moist deciduous, tropical semi-evergreen and wet alluvial grasslands characterize the vegetation of MBR. The invasive trees on the alluvial grassland habitat have formed the characteristic tropical scattered forest of MBR. The climate of MBR is moist tropical with average annual rainfall between 300-400 mm. The major rainy season is from May to September. It rains often even in March, April and October, but rarely in February and November. The winter months of January and December are comparatively dry. January is the coldest month when the minimum temperature often drops to 5°C and the maximum

stays between19° C to 25° C. The summer from May to September that is also the rainy season, when the maximum temperature prevails.

Nameri National Park

The study was carried out in the Nameri National Park, situated 40 km away from the town of Tezpur within the district of Sonitpur, Assam (27°35′-26°50′ N latitude and 92° 39′- 93° 0′ E longitude) with an area of 200 km². The Pakhui Sanctuary of Arunachal Pradesh adjoins the study area on its northeastern point. The study area is a narrow strip lying between Kameng district of Arunachal Pradesh and river Brahmaputra, covered mostly by a tropical semi-evergreen forest patches. It is a part of Naduar reserve forest; the oldest reserve forest of Assam, which was constituted way back in 1878 (Das, 1998). The topography of the study area is characterized by undulating terrains and plains with a variation of altitude from 90-210m msl. During 1998, 200 km^2 of the study area has been declared as a National Park to protect the age-old habitat.

The detailed habitat characteristic of Nameri National Park was studied by Saikia and Kakati (1999) and the forest is mainly moist mixed semi-evergreen forest. The climate of study area could be characterized by high humidity and copious rainfall. The season can be classified into pre-monsoon (March –May), monsoon (June-August.), re-treating monsoon (Sep. to Nov.) and winter (Dec.-Feb.). Average annual rainfall in the study area from 1971-1998 is 2,141mm (data were collected from the Environmental Science Department, Gauhati University, Assam, India). More than 70% annual rainfall is received in the study area from May to September. The overall temperature variation between summer and winter is 36ºC (sunny days of July-August) to 11ºC (December and January).

Holongapara-Gibbon WLS

The Hollongapara Gibbon Wildlife Sanctuary, formerly known as Gibbon Wildlife Sanctuary or Holongapara Reserve forest is an isolated protected area of evergreen forests patches located in eastern Assam, India. It lies between 26º40'-26º45' N latitude and 94º20'-94º25' E longitude with a height of 100-120 msl near Mariani, Jorhat district, Assam (Ghosh, 2007). Set aside initially in 1881, its forests used to extend to the foothills of the Patkai hill range. Since then, the forests has been fragmented and surrounded by tea gardens and small villages. The Bhogdoi River creates a waterlogged area dominated by semi aquatic plants along the border of the sanctuary, helping to create three distinct habitat zones or micro-ecosystems such as the up-slope zone, the down-slope zone and the flood-prone zone. The sanctuary remains fragmented into five distinct segments with a total area of 20.98 km^2. In the early 20th century, artificial regeneration was used to developed well-stocked forest, resulting in the sites rich biodiversity. The upper canopy of the forest is dominated by the Hollong tree (*Dipterocarpus macrocarpus*), while the Nahor (*Mesua ferrea*) dominates the middle canopy. The lower canopy consists of evergreen shrubs and herbs. The sanctuary has a rich biodiversity and the potential home for the only apes of India, the Western Hoolock Gibbon (*Hoolock hoolock*) as well as the rare Bengal Slow Loris (*Nycticebus bengalensis*). Other important primate includes the Stump-tailed Macaque (Macaca arctoides), Northern Pigtailed Macaque (*Macaca leonina*), Eastern Assamese Macaque (*Macaca a. assamensis*), Rhesus Macaque (Macaca *mulatta*) and Capped langur (*Trachypithecus pileatus*). At least 219 species of birds and various types of snakes are known to harboars in the sanctuary (Devi and Saikia, 2010). The climatic condition of the study area could be divided into four seasons viz., pre-monsoon, monsoon, retreating monsoon and winter. Pre-monsoon season prevails from March-May, monsoon from Jun to August, retreating monsoon from Sep. to November and winter season from December to February. Average temperature ranges from 18.95ºC - 27.9ºC and average humidity ranges between 64.5% and 94.5%. It receives 249 cm (98 inches) of rainfall on average per year.

Jeypore RF and part of Dihing Patkai WLS

Jeypore Reserve Forest and part of Dihing Patkai WLS is located at Dibrugarh District of Upper Assam which falls between 27'06'– 27°16'N and 95°21'–95°29'E. The total area of the study is 108 km^2. The terrain of the area varies with slightly undulating plains to hills which are the foothills of the Patkai Range. The Reserve Forest is continuous with the forests of Arunachal Pradesh. Burhi-Dihing and the Dilli rivers form a part of the boundary of the study area. Many small perennial streams and nullahs also flow within the forest. Swamps and grassland patches also occur inside the forest. The habitat is tropical rainforest, described it as "Assam Valley Tropical Wet Evergreen Forest" also called the upper Assam *Dipterocarpus – Mesua* forest. The forest is characterized by a top canopy dominated by *Dipterocarpus macrocarpus* reaching heights of 50m, a middle canopy dominated by *Mesua ferrea* and *Vatica lanceaefolia* and undergrowth consisting of woody shrubs such as *Saprosma ternatum, Livistonia jenkinsiana* and canes *Calamus erectus,* etc. Bamboo species such as *Dendrocalamus hamiltonii, Pseudostachyum polymorp*hum and climbers such as *Derris oblonga* are common. The major fauna of the reserve include large mammals such as Elephant *Elephas maximus*, Barking Deer *Muntiacus muntjak*, Bengal Tiger *Panthera tigris*, Leopard *Panthera pardus*,

Clouded Leopard *Neofelis nebulosa*, Wild Boar *Sus scrofa*, etc. Primates such as Hoolock Gibbon *Hoolock hoolock*, Capped Langur *Trachypithecus pileatus* and Rhesus Macaque *Macaca mulatta* are also found in the reserve. Rock Python *Python molurus vitatus* and Banded Krait *Bungarus fasciatus* are some notable reptilian species. Besides these major faunas the reserve also harbours a large diversity of butterflies and arachnid species. Although the forest is located in a matrix of tea plantations, settled agriculture and rural settlements, the degree of disturbance is much less compared to other protected areas of the state. The peripheral areas of the forest are encroached by the local people for tea plantations but the core area of the forest is intact and without any disturbance.

Chandubi RF

Study has been carried out in Chandubi Tropical Forest during 2009-2012 (Coordinates: 26° 50′-26°55′N and 91°20′-91°30′; altitude: 40-200m MSL) with covering an area of 166 km^2 in Kamrup District, Assam, India. It is basically located in the hilly terrain covering a small-extended plain in the down slopes of the hills. The hills are actually continuation in the form of spurs of Khasi Hill ranges of Eastern Himalayan biodiversity hotspot. The habitat is an undulating hilly terrain, the forests are located in alluvial tarries and undulating terrain and these are cut up by numerous narrow water channels and streams. The study area has unique geologic and physiographic make up of the state and is composed of special habitat mosaic. The Meghalaya hill ranges on the North-west and North-east, and the Chandubi Tectonic Lake on the west. The climate of study area is mesothermal humid climate, gets heavy rainfall (300-450cm) in addition to periodic wind, storm and thunders (Borthakur, 1986). On the basis of temperature, humidity and precipitation pattern, the climate of Chandubi could be divided into four distinct season viz., Pre-monsoon, Monsoon, Re-treating monsoon and winter. The rainfall, fogs and temperature were found to change in relation to different seasons and in different physiographic areas within it.

Rani-Garbhanga RF

The study has been carried out in Rani-Garbhanga Reserve forest (RGRF) of Kamrup District, Assam from 2004 to 2008. The detailed physiography and location of the study area are given in the following sub sections. The study area of Rani-Garbhanga reserve forest is located within 25°45'-26°30' N latitudes and 9°0'-91°55' E longitudes with an elevation of 40-744 m MSL. Majority of the study area is composed of hills and hillocks and the highest hill is found in Moinakhulung area. Total study area of the Garbhanga reserve forest is 18,860.50 hectares belonging to 4 different beats viz. Basistha, Mainakhulung, Lakra and Unthana; whereas, the total area of Rani Reserve forest is 6,624.85 hectares, under 3 different beats viz. Rani, Kawasing, and Jorasal. The Garbhanga reserve forest is the largest reserve forest of Kamrup district situated adjacent to Greater Guwahati and southern bank of river Brahmaputra, which has been declared way back in 1926, under Government notification No.1992–R-dt. 15.7.26. The Kawasing R.F. of the Rani range was notified under notification No. 12 dt. 7/3/1883 with an area of 998.00 hectares, the Jorasal RF was notified under notification No.5 dt. 17/10/1878 covering an area of 1,256 and the Rani R.F. was notified under notification No. 13 dt. 26/7/1882 covering an area of 4, 370 hectares. The entire study area is mainly positioned in the hilly terrain covering a small-extended plain in the down slopes of the hills. The hills are actually continuation in the form of spurs of Khasi Hill ranges. The plain forests are located in alluvial tarries and these are cut up by numerous narrow, winding low-lying tracts. The height of terrain may vary from 1-15 m from the neighbouring 'low-lying' tracts. The study area is the unique geologic and physiographic make up of the state and is composed of special habitat mosaic. Jalukbari Proposed Reserve Forest, Deepar beel Bird Sanctuary and NH 37 is on the south border of the study area, Meghalaya Hill ranges on the north, the River Brahmaputra on west, and Khanapara and Amsang Reserve Forest on the east.

Gauhati University Campus

The study sites of Gauhati University campus, Jalukbari has covered the area of Gauhati University Campus, University Botanical garden, Satmile area and Kaleswar Hill area that have lies between 25°5" - 25°53" N latitude and 91°22" E to 91°28" E longitude in the direction of south west corner of Kamrup district and in the southern bank of river Brahmaputra. It is located about 8 km apart from the major cosmopolitan centre of Guwahati city. The average total area covered was approximately 40 km^2, most of which are undulating hilly terrain and floodplains of river Brahmaputra. The plain includes the parts of Gauhati University Campus (including gardens, University residential campus, Institutional campus, etc.), Sundarbari, Satmile and the hilly area includes the hills of University etc. The area is highly rich with natural and cultivated flora. The vegetation of low hilly area within Gauhati University Campus and Botanical garden is highly dense but reduce gradually its density with the declination of height. Diverse types of vegetation are found throughout Gauhati University campus and Jalukbari, which represents evergreen, semi-evergreen, deciduous type, shrubs and grasslands of tall and short. The climate of Gauhati University campus, Jalukbari is tropical mesothermal with high humidity and moderate temperature.

Climatically, the study area could be divided into four distinct seasons such as winter (December to February), pre-monsoon (March to May), monsoon (June to August) and retreating monsoon (September to November). Again, on the basis of average total rainfall, the months from April to September (total 6 months) could be distinguished as wet season and October to March could be distinguished as dry season (Source: Department of Environmental Science, Gauhati University). The temperature ranges between 10.6° C - 32°C and the average annual precipitation ranges between 300-400mm. The most rainfall occurs during monsoon period with a maximum temperature of 32°C and minimum temperature of 24° C and relative humidity between 55.5-85.5%.

Methods of Study

The Samplings were made between November 2000 and April 2014, to collect the butterfly data using transect methods described by Pollard *et al.* (1975) and Pollard (1977), with some modifications described in the text. The point transects were established on previously laid line transact after an interval of 200 meters in each point to collect the butterflies and habitat data of the sampling zones. In point transacts, 200m gap were maintain between two point in each study sites.

Trap design

It is difficult to identify butterflies when they are in flight and therefore, the study focused on the guild of fruit feeding Nymphalid butterflies that could be caught in traps, baited with rotting fruits (as used by Hill *et al.*, 2001; Hamer *et al.*, 2003; Saikia, 2008; Saikia *et al.*, 2009). During this study, traps were used and baited with fresh and rotten Bananas and Jackfruits (De Vries, 1987; Daily and Ehrlich, 1995; Saikia, 2008; Saikia *et al.*, 2009). This guild comprises approximately 75% of all nymphalid butterflies recorded by Hill *et al.* (2001). Bait traps were hung at 200-m intervals along the transects at dense forest and altered forest and sampled butterflies for 7 consecutive days on two occasions, covering both winter and summer seasons (to account for seasonal variation in species abundance; Hamer *et al.*, 2005) at each site. Bait was placed in traps on the day prior to the first sampling day and was left in the trap for the rest of the sampling period. Fresh bait was added to each trap every second day, thus ensuring that all traps contained a mixture ranging from fresh to well-rotted bait. During each sampling period, traps were emptied daily and all trapped butterflies were identified where possible in the field (following Evans, 1932; Talbot, 1939; Haribal, 1992; Kehimkar, 2008), marked with a felt-tipped pen and released to avoid double count. The unidentified butterflies were collected and carried to the laboratory for study and preserved in the Biodiversity Museum of Gauhati University.

RESULTS AND DISCUSSION

New records

Altogether three new records of butterfly species have been made in Assam recently those were such as Indo-Chinese Tricolor Pied Flat-*Coladenia indrani uposathra* Fruhstorfer, Chocolate Grass Yellow-*Eurema sari sodalis* Moore and Khasi Hill Common Earl- *Tanaecia julii khasiana* Swinhoe and one new larval host-plant species (host-plant species was not recorded by any workers in Past) of Red Spot Jezabel-*Dalias discombasi discombasi* and life history parts. The detailed reports of the observations were described in detailed below:

1. New records of Indo-Chinese Tricolor Pied Flat- *Coladenia indrani uposathra* Fruhstorfer, 1911 Fig. 1

The species *Coladenia indrani uposathra* was newly recorded in Chandubi Reserve forest and Garbhanga reserve forest during winter and monsoon season of 2011 and 2007 survey respectively **(Fig.1)**. The species was reportedly too distributed from North Burma to Ataran, Siam, Singapur and Java (Evans, 1932) only, but, the species was recorded in the low hilly area of Chandubi and Garbhanga RF at 85-90 msl. However, this sub-species was earlier recorded by Saji and Churi (2014) in Tripura State of Northeast India. The other two subspecies namely *C. indrani indra* and *C. indrani indrani* were recorded in Indian Boundary from Mussoori –Sikkim and South India to Bengal respectively (Evans, 1932). Thus it was a very important record of hesperiidae butterflies within North Eastern region of India.

Fig. 1: Photograph of Indo-chinese Tricolor Pied Flat- *Coladenia indrani uposathra*

Distribution of other Tricolour Pied Flat Sub-species

The Tricolour Pied Flat has four subspecies namely, *Coladenia indrani tissa* Moore, *C. indrani indra* Evans, *C. indrani indrani* Moore and *C. indrani upasathra* Fruh. Of which, the subspecies *Coladenia indrani tissa* was distributed in Srilanka alone (Evans, 1932). The Morphological character of the *Coladenia indrani tissa* subspecies are as follows- Species is dark colour, markings small, cilia of hind wing is dark brown, upper forewing apical spots are small and irregular. Upper hind wing dark spots are diffused. The species *C. indrani indra* was reported to distribute in South India to Bengal (Evans, 1932). The morphological characters of the species *C. indrani indra* is as follows-Body colour is dark brown, markings are large, above and below prominent tawny sub-marginal spots and upper forewing apical spots are coalesced. The species *C. indrani indrani* M was reported to distribute from Mussoories to Sikkim (Evans, 1932; Talbot, 1939). The morphological characters are as follows-Body colour is tawny brown, upper hind wing black spots are sharply marked; sub marginal tawny spots are faint. Whereas, the species *C. indrani uposathra* Fruh.was reported to distribute from North Burma to Ataran, Siam, Singapur and Java (Evans, 1932). The morphological characters of the species is as follows-Above bright tawny ochreous, Upper hindwing black spots are sharply marked, upper forewing and below tawny spots are very large and prominent (Evans, 1932).

2. Chocolate Grass Yellow: *Eurema sari sodalis* Moore (WS-44 mm) Fig.2

Past Distribution

The Chocolate grass yellow - *Eurema sari sodalis* is reportedly distributed from Dawnas of South Burma subdivision to other areas of South Burma (Evans, 1932; Talbot, 1939). The main characters of the species are as follows-Under forewing apex entirely and broadly dark chocolate colour. The wing span ranges from 40-45 mm in length. However, Haribal(1992) was also reported in her Butterfly book regarding distribution of the species in Sikkim Himalaya (Haribal, 1992) and Keheimkar reported in his book that, the species was distributed in Sikkim and Arunachal Pradesh (Kahimkar, 2008).

New records

The species was found to distribute in Assam. In Manas National park first specimen was observed in Mothonguri forest range at the scrubland habitat dominated by *Eupatorium odoratum* and *Lantana camera* on 22nd November 2001 during regular field survey of Insect fauna in Manas Biosphere Reserve under MoEF BRRP funded project (2000-2004; Fig. 2). Later it was observed in Namrup RF on 8th March 2008. It is a new records and range extension of the species within Indian boundary after the reported distribution of the species by Evans (1932) and Talbot (1939) in Dawna range to South Burma, extending to the Malay Peninsula, Sumatra and North Borneo. The information of the species in Manas national Park was published in the butterfly checklist of the study area (Saikia and Saikia, 2006, 2014). The species was found to be very rare and only single individual was observed in each study location.

Fig. 2: Photograph of the Chocolate Grass Yellow-*Eurema sari sodalis*

Morphological Characters

Upper side deep bright yellow, markings as in *hecabe*, but marginal border more intensely black and with broader apical area; the inner edge of the excavated area, between veins 2 and 4, is directed towards the distal margin at a point just above the tornus, a character not found in other Indian *Eurema*. This species is easily recognized by the markings on the fore wing underside. This shows a large, black (but Evans, 1932 had mentioned as dark Chocolate) quadrate spot covering the whole of the apical area, a single cell-spot, and a black streak in 1b (see Figure 2 for the species)

3. Khasi Hill Common Earl: *Tanaecia julii khasiana* (Swinhoe) **Fig.3**

Past Records

Altogether three subspecies of Common earl have been found in Northeast India. The subspecies *Tanaecia juli khasiana* (Swin.) was reported from Khasi hills and *Tanaecia juli appiades* Men. was reported from Kumaon to Sikkim, whereas, the third subspecies *Tanaecia. j. sedeva.* was reported from Sylhet, Cachar, Manipur and N. Burma (Evans, 1932).

New Records

The subspecies *Tanaecia juli khasiana* (Swin.) was newly recorded in Chandubi reserve forest on

18 February 2010 and 15 May 2010 (Fig.3). Altogether three individuals were recorded and photographed, of which, one was female and other two were male butterfly. One pair of butterfly was recorded in a foot hill forest of Kathalguri reserve forest of chandubi and single individual was recorded in tall reeds of Northern part of Chandubi lake. It was an important finding of the species and as well as new add to the list of butterfly diversity of the state of Assam (Fig. 3).

Fig.3. Common earl (f) Chandubi RF

Common earl (M) Chandubi RF

4. New host plant of Red Spot Jezebel-*Delias descombesi descombesi* (Boisduvasl) Fig.4

Fig.4 New Host Plant-*Dendrophthoe falcate*

The Red-Spot Jezebel is not a rare species in Assam. The species was reported to distribute in India from Sikkim to Arunachal as per the past distribution records. The species was reported to distribute from Nepal to Burma at the elevation of 2000- 5000 feet (609.6-1500m) msl, but presently reported in 80m msl at Guwahati, Assam. Again, no distribution reports of the species have been made by Kehimkar (2008) in Assam. During field survey, it was found that, the species was commonly found in Assam particularly in Kamrup district. A large breeding colonies of Red spot Jezebel have been observed from 2006 to 2013 in retreating monsoon and winter at Jalukbari, Gauhati University campus (in front of the Author's residential Quarter). There was no such reports of the host plant of the species in any published literature of several authors (such as Haribal, 1992; Evans, 1932; Talbot, 1939; Kehimkar, 2008). Kehimkar (2008) has reported regarding host-plant species of Red-spot Jezebel that it is a data deficient.

The species was regularly sighted to breeds (aggregated lying) together at the same site in each year during winter season from 2006-2008. The food plant species of red spot Jezebel was *Dendrophthoe falcate* (L.F.) E. (Fam: Loranthaceae), locally known as "Roghumola" in Assam (i.e. tree parasite; Fig.4). The female laid 100 eggs in a single clutch in one single leaf surface and after that the newly hatch larvae were dispersed all over the *Dendrophthoe falcate* plants leaves available within the larval host plant of supporting trees. The egg was yellow and the larva was hairy and they are very comfortable to stay even same leaf or branch together and feeds the host plant leaves by sharing basis. The chrysalis formation and adult emerges were also found to be communal (See plate-1). The larvae were more voracious at the last instar and sometime they have changed the host plant by climbing on ground of the existing tree species nearby where the butterfly's parasitic host plant (*Dendrophthoe falcate*) was grown. The mature larvae moved to the main tree leaves and transformed into chrysalis together on the same leaf surface. The main enemy of the chrysalis was found to be the Small wasp (not identified till) and destroy the chrysalis. The butterfly was found to be used only specific host plant (as mentioned above) and that are growing on the branches of the host trees (in various species of host trees). The seeds of the larval host plants were dispersed by a small song birds named as Scarlet backed Flower-peckers-*Dicaeum cruentatum* in Assam who consumed the ripe adhesive fleshy fruits (Plate-1 for birds). The larval host plant (*Dendrophthoe falcate*) was widely distributed in Assam, so the butterflies. The larval host plant was grown on the branch of the tree where their seeds attached and later propagated within other branch (Plate-1).

Verification of past distribution records of butterflies

Altogether 53 butterflies species distribution records have been made in Assam during survey periods from 2000-2014 in the study sites covering the area of Manas NP, Jeypore RF, Namrup Forest, Gibbon WLS, Gauhati University Campus, Jalukbari, Chandubi RF and Nameri NP etc.(Table 1) that have not been documented by Kehimkar (2008) in his recently published literature. Of which, certain species have been mentioned in the published articles of the present authors (see Saikia, 2011, 2012, 2014; Saikia & Kalita, 2014; Saikia & Saikia, 2014; Saikia *et al.* 2010a; Saikia *et al.*, 2010b; Saikia *et al.* 2009; Saikia *et al.*, 2007; Saikia & Saikia, 2006; Saikia *et al.*, 2005). It is worth mentioning to note that, the distribution

records of these butterflies in Assam were although not clearly described with their specific sighting locations by the past workers (Evans, 1932; Talbot, 1939 etc.), but it should be cited by the Kehimkar (2008) in his recent book. Thus, the present report has clarified the status of the butterflies from the state of Assam. It is a very important piece of work that has been emphasized to documentation of butterflies corrected distribution records by the future butterfly workers. The reporting of butterflies were such as Papilionidae, 15, species, Nymphalidae, 20, species, Pieridae, 4, species, Lycaenidae, 13, species and Hesperiidae only 1 species in the study area (see Table-1 and Plate-2a-c).

Table 1: Authentication of butterflies in the states of Assam and their documented past distribution records, present sighting locations, habitats occurrences and local status (**NB**: Years mentioned in the table indicates the first sighting records; the past distribution records were written as per Kehimkar, 2008).

Sl. No.	Family/ Species	Sites Location & Year of records	Recorded habitats/ regional Status	Recorded Distributions in India (as per Kehimkar, 2008)
1	**Papilionidae** Red Helen-*Princeps h. helenus* Lin.	Nameri NP-2010; Chandubi RF-2009; Garbhanga RF, 2010; Jeypore, 2008, Jalukbari and GU Campus, Gibbon wildlife Sanctuary.	Open humid area and mud peddling; Common	S. India, Uttaranchal to Arunachal Pradesh
2	Yellow Helen-*P. nephelus chaon* (Westwood).	All the study sites, 2000 onwards	Open humid area and mud peddling, Forest habitats and flying; Common	Sikkim to Arunachal, Meghalaya
3	Great Zebra-*Pathysa xenocles phrontis* (De Niceville.)	Garbhanga RF, 2006; Jeypore RF-2008	Forest area; mud puddling ; and resting on stream bed Rocks; rare	Uttaranchal to Arunachal Pradesh
4	Lesser Zebra- *Pathysa macareus indicus* (Rothschild)	Nameri, near Bhalukpung-Arunachal border- 2011	Forest edges and open area; rare	Sikkim to Arunachal
5	Veined Jay-*Graphium bathycles chiron (*Wallacec)	Nameri NP , 2011	Forest and open habitat; common	Sikkim to Arunachal
6	Glassy Bluebottle-*Graphium cloanthus* (Westwood)	Nameri and Manas National Park, 2000 and Garbhanga RF-2007, rare than the Common bluebottle	Open area, Mud puddling and forest; very common	Jammu and Kashmir and Arunachal Pradesh
7	Common Mime-*Chilasa c. clytia (Lin.)*	All sites, since 2000; very common	Forest, scrubland, and open, common	Himachal Pradesh to Arunachal Pradesh, south India, and Eastern India
8	Spangle-*Princeps protenor euprotenor* (Fruhstorfer)	Nameri, 2009; rare	Mud puddling and scrubland attached to forest	Jammu and Kashmir to Arunachal Pradesh
9	Common Windmill-*Atrophaneura polyeuctes* (Doubl.)	Chandubi RF-2010; Garbhanga RF-2007; Manas- 2003.	Dense forest and near streams	Jammu and Kashmir to Arunachal Pradesh.
10	Great Windmill-*A. d.dasarada* (Moore)	Manas-2000; Garbhanga-2006; Chandubi-2009; Nameri NP-2009; Jalukbari 2006; Common	Forest habitat and in flight	Jammu and Kashmir to Arunachal Pradesh
11	Common Batwing-*A. varuna astorion*(White)	Nameri NP-2009; Manas NP-2002, Garbhanga RF-2007,	Forest, mud puddling and scrubland near	Uttaranchal to Arunachal Pradesh

		rare,	forest	
12	Lesser Batwing-*Atrophaneura aidoneus* (Doubl.)	Garbhanga RF, Manas, Nameri NP, Chandubi, 2000 onward		Uttaranchal to Arunachal Pradesh, Meghalaya
13	Crimson Rose-*Pachliopta. hector* (Linn.)	Manas, Jalukbari and Garbhanga RF, 2000, 2006, 2008; rare	Scrublands in hill forest	South India, Orissa, Jharkhand, West Bengal, Andaman
14	Golden Birdwing-*Troides aeacus* (C& R Felder)	All sites, since 2000, Common	Forest and hill side scrubland, Garden etc.	Uttaranchal to Arunachal Pradesh
15	Common Birdwing-*T. helena cereberus* (C& R Felder) WS: measure 191 mm	All sites, since 2000, common	Forest, mud puddling, scrubland near forest and hills	Orissa, Sikkim to Arunachal Pradesh, Andaman and Nicober Island
16	**Nymphalidae** **Sub-family: Satyrinae** Chumbe Wall- *Chonola masoni* (Elwes)	Manas-2000, very rare	river side moist scrublands at Mothonguri, Manas NP near Bhutan Border	Sikkim, Bhutan
17	Dusky Diadem-*Ethope himachala*(Moore)	Nameri-2008 near Bhalukpung camp, Garbhanga RF-2006, Chandubi 2009; Gibbon WLS-2008; Jeypore-2008, Namrup RF-2008, common	Shade area and forest edge inside dense forest	Sikkim to Arunachal Pradesh
18	Scarce Red Forester-*Lethe distans* Butler	Chandubi RF-2009, Garbhanga RF-2008 and Jalukbari Botanical Garden-2012, rare	Shade habitat on the leaf litter depositions and tree stumps, shade pool etc.	Sikkim to Arunachal
19	Chinese Bushbrown-*Mycalesis gotoma charaka* Moore	Jalukbari University Botanical Garden-2008; Chandubi 2010 rare	Hill forest scrubland in winter, ground zone leaf litters	Northeast , Arunachal Pradesh
20	Moore's Bushbrown-*Mycalesis heri* Moore	Nameri NP-2010, rare	Ground zones of dense forest, leaf litter deposits area, shade places	Uttaranchal, Sikkim, Nepal, Bhutan
21	Blue Stripe Palmfly-*Elymnius p. patna (*Westwood*)*	Garbhanga,-2006, Manas NP-2000, Jalukbari-2005, Jeypore RF-2008, rare	Near bamboo and cane forest, palm tree, banana plantations	Uttaranchal to Arunachal Pradesh
22	Tiger Palmfly- *Elymnias singhala (nesaea timanda)*	Nameri-2010, very rare	Forest intersperse, open area Near cane and bamboo forest	Sikkim
24	Dark Catseye-*Zipoetis scylax* Hewitson	Nameri NP-2011, Jeypore RF-2008	Ground zone in forest habitat	Sikkim
	Sub-family: Nymphalinae			
25	Sullied Sailer-*Neptis s. soma* Moore	Garbhanga RF-2006, Chandubi RF-2009, Nameri 2009, rare	Forest edge, scrubland in dense and forest edges	South India, up to Karnataka, Madhya Pradesh, Jammu and Kasmirto Arunachal Pradesh, Andaman
26	Himalayan Sailer-*N. mahendra* Moore	Garbhanga-2007, Chandubi-2009, Manas-2002, rare	Forest understory and forest edges	Jammu and Kasmirto Arunachal Pradesh,

27	Grey Commodore-*Bhagadatta austenia* (Moore)	Nameri NP-2011, very rare	Dense forest underground, forest edges	Manipur, Arunachal Pradesh
28	Archduke-L*exias khasiana* (Swinhoe)	Gibbon WLS, Garbhanga RF, Jeypore RF-2008	Dense forest gap	Manipur and Mizoram
	Sub-family: Charaxinae			
29	Great Nawab-*Polyura e. eudemippus(*Doubleday*)*	Manas NP-2001, Chandubi RF-2009, Garbhanga RF-2009	Wet area in forest intersperse	Uttaranchal to Arunachal Pradesh
30	Pallid Nawab-*P. arja* (Felder &Felder	Manas-2003, Garbhanga RF-2006 and Chandubi RF-2009	Forest Edge and stream beds	Sikkim to Arunachal Pradesh
	Sub-family: Danainae			
31	Dark Blue Tiger-*Tirumala septentrionis*(Butler)	Nameri NP-2011	Forest undergrowth	Peninsular India up to southern Maharashtra, Orissa, Himachal Pradesh eastward to Arunachal Pradesh, Nepal Bhutan, Bangladesh, Myanmar, Srilanka.
32	Chestnut Tiger-*Parantica s. sita*(Kollar)	Gibbon WLS-2008, Nameri -2011, rare	Forest Gap, Degraded forest in Gibbon WLS.	Jammu and Kasmir eastwards to Arunachal Pradesh in India.
33	Chocolate Tiger-*Parantica melaneus platiniston* (Fruhstofer)	Manas NP-2001, Chandubi-2009, Garbhanga 2007, common	Forest edge and forest understory and canopy layer	Sikkim to Arunachal Pradesh in India
34	Long Branded Blue Crow-*Euploea algae deione* (Fruhstofer)	Nameri NP-2011, Rare	Open area, mud pebbling and scrublands in forest gap	Sikkim to Arunachal Pradesh in India; Bhutan Bangladesh and Myanmar
35	Blue Spotted Crow-*E. midamus rogenhoferi* Linnaeus	Nameri NP-2010, rare	Forest Gap, Mud Puddling	Himachal Pradesh to Arunachal Pradesh in India
	Pieridae			
36	Tree Yellow-*Gandaca harina assamica* (Moore)	Garbhanga RF-2006; Nameri NP-2010	Open area, Mud Puddling	Sikkim to Arunachal Pradesh
37	Chocolate Grass Yellow-*Eurema sari*(Moore)	ManasNP-2000	Open area near forest	Sikkim to Arunachal Pradesh
38	Chocolate Albatross-*Appias lyncida elenora* (Boisduval)	Common in All sites	Open habitat	South India, Uttaranchal, Sikkim to Arunachal Pradesh
39	Red-Spot Jezebel-*Delias d. descombesi* (Boisduval)	Garbhanga, jalukbari-2007	Open habitat and forest area	Sikkim to Arunachal Pradesh in India
	Lycaenidae			
40	Angle Sunbeam-*Curetis dentata* Moore	Common in all sites	Scrubland forest	South India up to Madhya Pradesh, Himachal Pradesh to Arunachal Pradesh
41	Large Oakblue-*Arhopala a. amantes* (Hewitson)	Garbhanga RF-2006, Chandubi RF-2009 Nameri NP	Scrublands and undergrowth vegetation	Uttaranchal to Arunachal Pradesh, West Bengal, South Bihar, Peninsular India up to Gujrat and Madhya Pradesh
42	Hewitson's Dull Oakblue-*Narathura. aenea* (Hewitson)	Manas NP-2000	Undergrowth vegetation	Himachal Pradesh to Arunachal Pradesh)
43	Indian Oakblue- *Narathura*	Garbhanga-2006,	-Do-	West Bengal, Orissa,

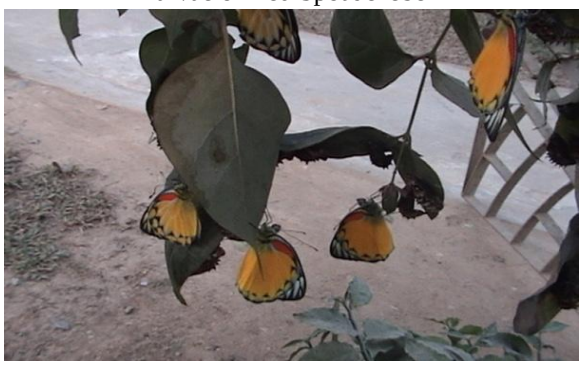
	alemon De Niceville	Jalukbari2007		Chhattisgarh, Madhya Pradesh, Himachal Pradesh to Arunachal Pradesh
44	Yamfly-*Loxura atymnus continentalis* (Fruhstorfer)	Jalukbari, Rani Garbhanga, Chandubi, Manas, Nameri, Jeypore RF, Gibbon WLS, common	-DO-	Uttaranchal to Arunachal Pradesh, Bengal, Peninsular India up to Maharastra, South Bihar and Madhya Pradesh in India
45	Common Onyx-*Horgora o. onyx* (Moore)	Manas NP-2000, Jalukbari, Gibbon WLS, Chandubi RF-2007, Garbhanga RF-2009	-DO-	Western Ghat, Maharastra southwards, Himachal Pradesh, to Arunachal Pradesh
46	Green Flash-*Artipe eryx* (Linnaeus)	Nameri NP-2010	Forest habitat	Sikkim to Arunachal Pradesh, Andamans
47	Longbanded Silverline-*Spindasis lohita himalayanus* (Horsfield)	Nameri NP-2010, Jalukbari-2008, Gibbon-2008Comon	Herbs	Uttaranchal to Arunachal Pradesh, West Bengal, peninsular India up to Madhya Pradesh.
48	Golden Sapphire-*Heliophorus brahma* Moore	Manas-2000, rare	Herbs and shrubs	Uttaranchal to Arunachal Pradesh, West Bengal(Northern Region)
49	Elbowed Pierrot-*Caleta elna noliteia* Fruhstorfer	Manas-2000, Nameri 2011	Open area and herbs and shrubs	Orissa Sikkim, Arunachal Pradesh
50	Angle Pierrot-*Caleta caleta decidia* Hewitson	Manas-2001, Nameri NP-2010	-DO-	Penninsular India up to Gujrat and Madhya Pradesh, West Bengal, Uttaranchal to Arunachal Pradesh
51	Metallic Cerulean-*Jamides alecto eurysaces* Fruhstorfer	All the study sites	-Do-	Penninsular India up to GUjrat and Madhya Pradesh, West Bengal, Uttaranchal to Arunachal Pradesh
52	Dark Pierrot-*Tarucus ananda* (De Nicevlle)	Manas-2001, Jalukbar-2010	Do	Penninsular India up to Gujarat and Madhya Pradesh, West Bengal, Uttaranchal to Arunachal Pradesh
	Family: Hesperiidae			
53	Fulvous Pied Flat-C*oladenia dan festa* Evans	Manas-2001, Nameri NP-2010, GArbhanga-2006, Chandubi-2009, Jalukbari-2010	-do-	South India, Himachal Pradesh to Arunachal Pradesh

Host plant (Loranthaceae: *Dendrophthoe falcate*

Egg of Red Spot Jezebel

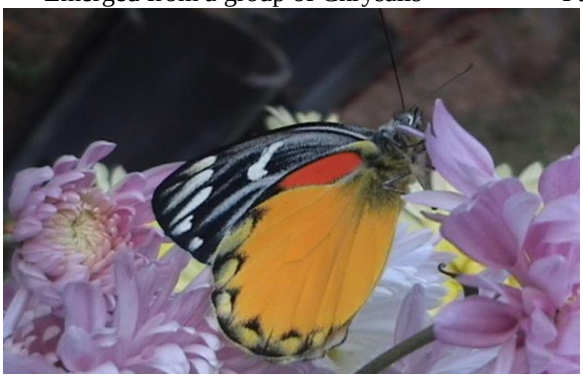
Larvae of Red Spot Jezebel

Communal Crysallizing by Red-Spot Jezebel



Emerged from a group of Chrysalis

Full Grown Chrysalis before adult emerging



Newly emerged butterfly

Scarlet backed Flower pecker

Plate 1: Host Plant, Eggs, Larvae, Chrysalis, adult and bird species help to seed dispersal of Red Spot Jezebel

***Lethe distans* (18)**

Ethope himachala (17)

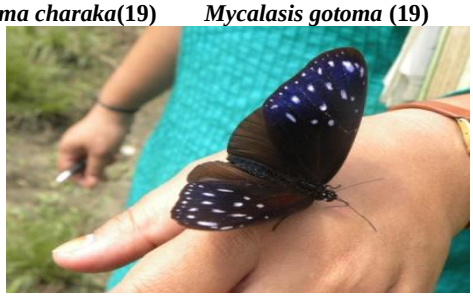
***Elymnias patna patna* (21)**

Elymnias singhala(22)

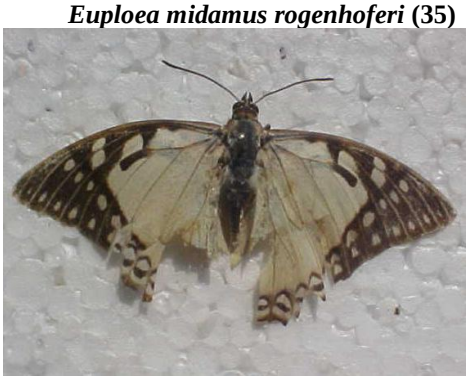
***Mycalasis gotoma charaka*(19)**

***Mycalasis gotoma* (19)**

***Euploea midamus rogenhoferi* (35)**



***Euploea midamus rogenhoferi* (35)**



***Polyura e. eudemippus* (29)**

***Polyura e. eudemippus* (29)**

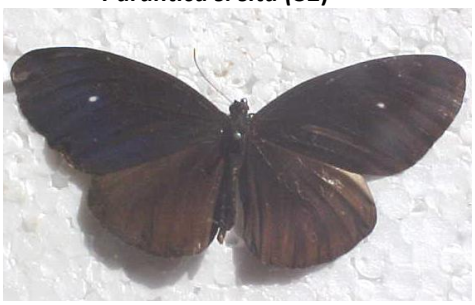
***Parantica s. sita* (32)**

***Parantica s. sita* (32)**

Plate-2(a): Authentication of butterflies records in Assam where recent documentation suggests no information (Family: **Nymphalidae**) (**NB**: Numbers in bracket indicates the serial numbers of the species in Table-1).

***Parantica s. sita* (32)**

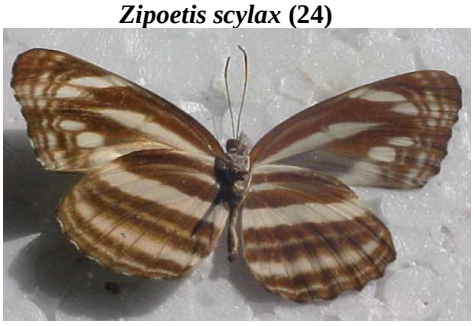
***Parantica melaneus platiniston* (33)**



***Euploea algae deione* (34)**

***Zipoetis scylax* (24)**

***Neptis s. Soma* (25)**



***Neptis s. soma* (25)**

***Neptis mahendra* (26)**

***Neptis mahendra* (26)**

***Tirumala septentrionis* (31)**

***Bhagadatta austenia* (27)**

Plate-2(b): Authentication of butterflies records in Assam where recent documentation suggests no information (Family: Nymphalidae) (**NB**: Numbers in bracket indicates the serial numbers of species in Table-1).

Plate-2(c): Authentication of butterflies records in Assam where recent documentation suggests no information (Family: Pieridae and Lyecanidae, Hesperiidae and Papilionidae respectively) (**NB**: Numbers in bracket indicates the serial numbers of species in Table-1).

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