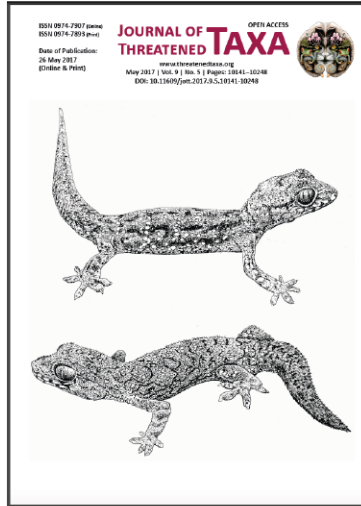


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## Journal of Threatened Taxa

Building evidence for conservation globally

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ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

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26 May 2017 | Vol. 9 | No. 5 | Pp. 10198–10207  
10.11609/jott.2841.9.5.10198-10207



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ISSN 0974-7893 (Print)

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 May 2017 | 9(5): 10198–10207

## BUTTERFLY FAUNA OF BAGHMUNDI, PURULIA, WEST BENGAL, INDIA: A PRELIMINARY CHECKLIST

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**Abstract:** The butterfly diversity of Baghmundi, Purulia District (22.60°–23.50°N & 85.75°–86.65°E), West Bengal, India was studied from January 2014 to December 2015 with photographic documentation. A total of 54 butterfly species were recorded representing 39 genera in six families. Nymphalidae was the most dominant family with 46.3% of the total species. As this is the first report of butterfly diversity from this region, the present study may help in planning conservation strategies and generate awareness among the local people and government authorities to save wildlife and their habitats.

**Keywords:** Butterfly diversity, Chota Nagpur Plateau, Indian Wildlife (Protection) Act, 1972, Lepidoptera, Purulia.

Butterflies are a taxonomically well-studied group throughout the world (Ghazoul 2002) and are indicator taxa in terms of habitat quality and anthropogenic disturbance (Kocher & Williams 2000). More than 18,000 butterfly species have been documented worldwide (Heppner 1998; Martinez et al. 2003; Larsen et al. 2011) including 1,311 species reported from India (Varshney & Smetacek 2015).

Purulia District is situated in the western part (22.60°–23.50°N & 85.75°–86.65°E) of West Bengal, India and the Baghmundi block is located within the Purulia Sadar West subdivision of Purulia District. This Block has a common boundary with as many as four other Blocks

(Balarampur in the east, Arsha and Jhalda-II in the north, and Jhalda-I in the west) of Purulia District and the state of Jharkhand (in the south). The area forms the lowest step of the Chota Nagpur Plateau having undulating land with scattered hills and dales. The northern and eastern portions of the block are covered with dense dry deciduous forest. Other portions have hard dry lands with scattered bushes and jungle. Baghmundi forest range has a total forest cover of 142.45km<sup>2</sup>. The forest falls under northern tropical dry deciduous forest and are mostly Coppice Sal *Shorea robusta* forest mixed with miscellaneous species like Palash *Butea monosperma*, Kusum *Schleichera oleosa*, Mahua *Madhuca longifolia*, Neem *Azadirachta indica* and Kendu *Diospyros melanoxylon* (Das 2016). Seventy-four trees, 59 shrubs, 23 climbers and 27 bamboos are the main reported floral species found in Purulia Forest Division.

Topographically, the north side of the block is separated by east-west water divider of Ajodhya range from other blocks like Arsha, Balarampur and Jhalda. River Subarnarekha separates the block from the Jharkhand State in the west and 'Sakha' River separates it from Balarampur block in the east. Purulia is one of the drought prone districts of West Bengal. It

**DOI:** <http://doi.org/10.11609/jott.2841.9.5.10198-10207> | **ZooBank:** urn:lsid:zoobank.org:pub:8EC1E7A6-642D-4CD3-AA94-F3FB8073B0F3

**Editor:** Sanjay Sondhi, Titli Trust, Uttarakhand, India.

**Date of publication:** 26 May 2017 (online & print)

**Manuscript details:** Ms # 2841 | Received 19 June 2016 | Final received 19 April 2017 | Finally accepted 01 May 2017

**Citation:** Samanta, S., D. Das & S. Mandal (2017). Butterfly fauna of Baghmundi, Purulia, West Bengal, India: a preliminary checklist. *Journal of Threatened Taxa* 9(5): 10198–10207; <http://doi.org/10.11609/jott.2841.9.5.10198-10207>

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**Funding:** Self-funded.

**Competing interests:** The authors declare no competing interests.

**Acknowledgements:** The authors are grateful to the Principal, J.K. College, Purulia; Principal, Bangabasi College, Kolkata and Principal, Bagnan College, Howrah for the facilities and support provided to carry out the work. The authors are thankful to the face book groups "Butterflies of India" and "Identify your Butterfly" for rendering help in identifying some of the butterfly photographs. The authors are also grateful to the editors and reviewers.

has a sub-tropical climate and is characterized by high evaporation and low precipitation. Its temperature is very high in summer and low in winter which varies from 2.8 degrees in winter to 52 degrees in summer. Rainfall defines the climate of the district. South-west monsoon is the principal source of rainfall in the district. Average annual rainfall varies between 1,100mm and 1,500mm (Das 2016). The relative humidity is high in the monsoon season, being 75% to 85%, but in summer it comes down to 25% to 35%. Due to undulated topography, nearly 50% of the rainfall flows away as runoff. The area is covered by mostly residual soil formed by weathering of bed rocks.

The biodiversity of the Purulia District has been hardly studied till date (Das 2016). There is no recent published report about the butterfly diversity of the Purulia District. Keeping this scenario in mind, the present study was undertaken to evaluate the butterfly diversity of Baghmundi block of Purulia District and prepare a checklist of butterflies for further scientific studies.

**MATERIALS AND METHODS**

**Selection of study sites**

The present study was conducted at three different study sites (Site 1, 2 and 3) with three different habitat types located in the Baghmundi block of Purulia District (22.60<sup>0</sup>–23.50<sup>0</sup>N & 85.75<sup>0</sup>–86.65<sup>0</sup>E), West Bengal, India (Fig. 1). Name, geographic location, altitude, habitat and vegetation types of the three study sites are presented in Table 1. The selection of study sites were made based on the range of habitat types and ease of access for observation of butterfly diversity. Baghmundi Village and adjoining areas were selected as Site 1 (Image 1). It is a rural area with human settlements and mixed vegetation like paddy fields, vegetable and flower gardens, bushes and scattered trees like *Sal Shorea robusta*, *Palash Butea monosperma*, *Mahua Madhuca longifolia* and *Neem Azadirachta indica*. Site 2, the Turga Dam area, is a vast wetland with swamps and bushes (Image 2). Site 3, the Dowry Khal area, has rocky undulating hills with moist deciduous forest and a hill stream flowing through it (Image 3).

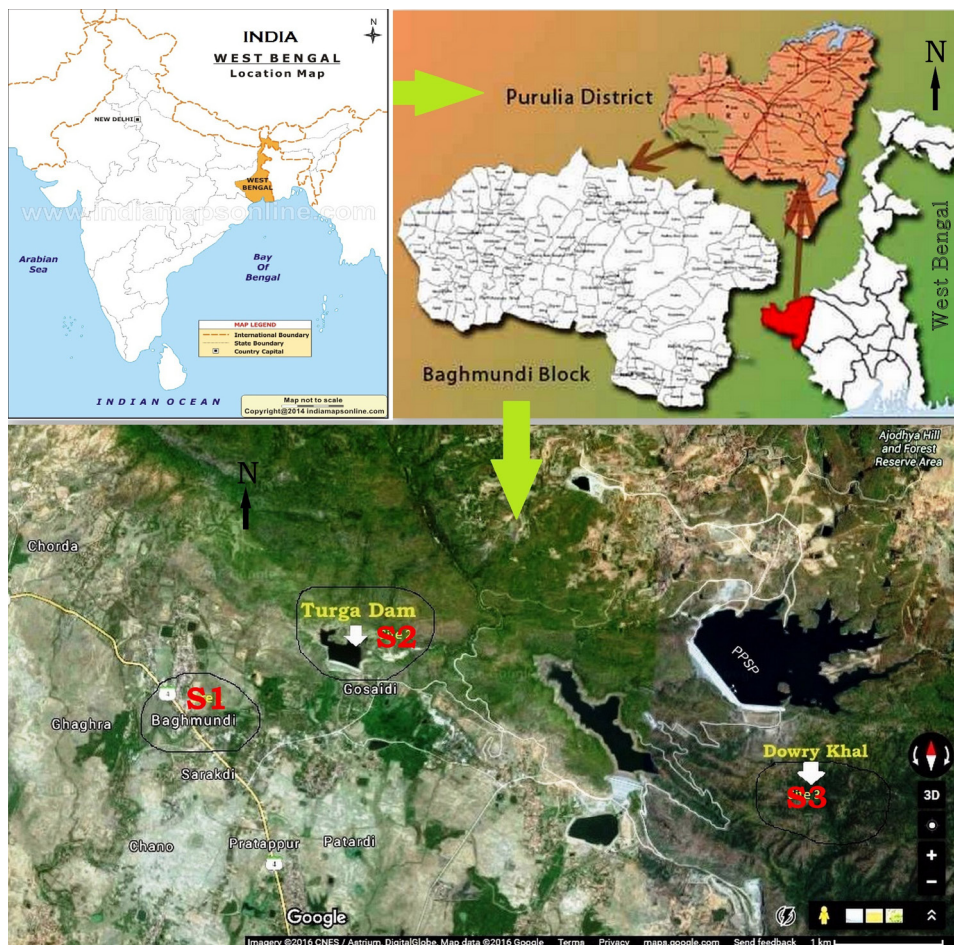


Figure 1. Study sites (S1, S2 and S3) under present investigation from the Baghmundi block of Purulia District, West Bengal, India.



**Table 1. Name, geographic location, altitude, habitat and vegetation types of the three study sites.**

Study Site	Geographic location	Altitude (m)	Habitat and Vegetation type
Site 1, Baghmundi Village	23.1963N & 86.0467E	259.5	Rural area with human settlements and mixed vegetation
Site 2, Turga Dam area	23.1987N & 80.0637E	272.7	Wetland with swamps and bushes
Site 3, Dowry Khal area	23.1856N & 86.1072E	363.1	Rocky hill area with moist deciduous forest and a hill stream flowing through it.

### Data collection

The butterflies were observed and recorded directly in the field. A combination of direct search technique (Sutherland 1996) and opportunistic sighting methods were applied for the present study which were conducted for two consecutive years (January 2014 to December 2015) to record butterfly diversity and abundance. Observations were made at a frequency of twice a month for each study area (a total of 48 samples from each study site) involving different habitat types. Observations were made between 08.30hr and 15.30hr during periods of good weather (no heavy rain or strong winds). This timing was found ideal based on preliminary observations done during different times of the day in the study sites. Butterflies were photographed using digital cameras (Nikon D5200 and Canon Power shot SX500IS) and identified using suitable keys (Evans 1932; Wynter-Blyth 1957; Haribal 1992; Kunte 2000; Kehimkar 2008). In critical conditions when identification was not possible by the naked eye or could not be photographed, as in the case of cryptic butterflies, they were captured by hand net following Tiple (2012), identified and released in the same habitat from where they were captured with least disturbance. Appropriate precautions were taken to ensure that the scales present on the wings of the butterflies were minimally affected. Photographs were preserved for taxonomic documentation. During each sampling, efforts were made to list the encounter frequencies of different butterfly species from different sampling sites. Encounter rates of each species has been represented as W (Widespread), C (Common), O (Occasional) and R (Rare) to denote the most common to the rarest butterfly species based on sighting frequencies. W, C, O and R represent 75–100 %, 50–74.99 %, 25–49.99 % and ≤24.99% of sighting from the sites of their occurrence throughout the entire study period respectively. During the data analysis, one complete year was divided into four seasons— (1) summer (March to May), (2) monsoon

**Image 1. Study site S1, Baghmundi Village and adjoining area****Image 2. Study site S2, Turga Dam area****Image 3. Study site S3, Dowry Khal area.**

(June to August), (3) post-monsoon (September to November), and (4) winter (December to February). Data of same season for the two successive years were



accumulated for season wise analysis of the data. The data analysis was carried out using Microsoft Office Excel, 2010.

## RESULTS

The diversity of butterfly species of Baghmundi varied during the study period by season and site. A total of 54 butterfly species belonging to 39 genera and six families were recorded during the study period from all the three study sites (Images 4–8). A family-wise check list containing common and scientific names along with site and season of sighting and encounter frequencies of each species are presented in Table 2. Among the six families of butterflies recorded in this study, Nymphalidae was the most dominant with 25 species belonging to 17 genera (46.3% of total species) followed by Lycaenidae (8 genera and 9 species, 16.7% of total species), Papilionidae (3 genera and 8 species, 14.8% of total species) and Pieridae (6 genera and 7 species, 13% of total species) (Fig. 2). Riodinidae showed the lowest species richness (only one species, 1.9% of total species) followed by Hesperidae (only four genera and species, 7.4% of total species). Among the 54 butterfly species observed during the study Common Lime *Papilio demoleus* and Grey Pansy *Junonia atlites* were most active and abundant throughout the year and in all the three study sites while Double-banded Judy *Abisara bifasciata*, Indigo Flash *Rapala varuna*, Purple Leaf Blue *Amblypodia anita*, Common Baron *Euthalia aconthea*, Black Rajah *Charaxes solon*, Brown Awl *Badamia exclamationis* and Five-bar Swordtail *Graphium antiphates* were very rare as they were seen only once during the entire study period.

The ratio of species to genus was 1.38. The genus *Junonia* was most diverse represented by six species while the genus *Papilio* was represented by four species and the genus *Graphium* were represented by three species. The genera *Rapala*, *Euthalia*, *Ypthima*, *Danaus* and *Catopsilia* were represented by two species each and the remaining 32 genera were represented by a single species.

Among the three sites selected for the present study the highest number of butterfly species was recorded from site 2, the Turga Dam area (41 species, 75.9% of the total recorded species) followed by site 1, the Baghmundi Village area (39 species, 72.2% of the total recorded species) (Fig. 3). The least number of butterfly species was recorded from site 3, the Dowry Khal area (26 species, 48.1% of the total recorded species). A maximum of nine unique butterfly species (species recorded only from this particular site among the three

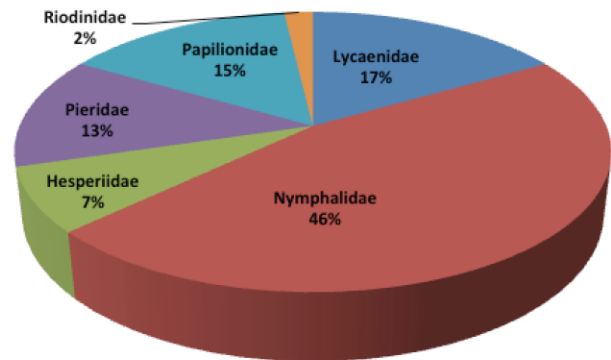


Figure 2. Family wise abundance of butterflies

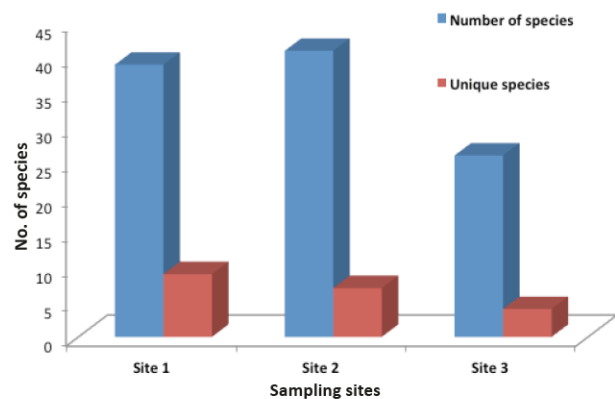


Figure 3. Total number of butterfly species and number of unique species (species recorded only from one particular site among the three study sites) recorded from three study sites.

study sites) was recorded from site 1 followed by site 2 (seven unique species). A minimum of only four unique species was recorded from site 3.

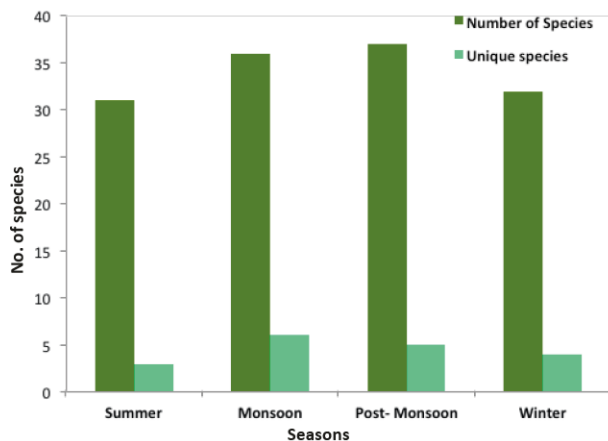
Butterflies were most abundant in the post-monsoon and monsoon seasons with 37 and 36 recorded species respectively while a lesser number of species was recorded during summer and winter (31 and 32 butterfly species respectively) (Fig. 4). The number of unique species was also higher during the monsoon and post-monsoon (6 and 5 unique species respectively) while it was low during summer and winter (3 and 4 unique species respectively).

## DISCUSSION

This is probably the first report of butterfly diversity from the western part of West Bengal consisting of the lowest step of the Chota Nagpur Plateau. There are only a few reports available till date about the butterfly diversity of the entire Chota Nagpur Plateau eco-region. Both of the two recent documentations about the butterfly diversity of this eco-region are from the Jharkhand State. Study by Singh (2010) documented



**Image 4.** Butterfly representing family Lycaenidae taken from three study sites.  
 1 - *Castalius rosimon*; 2 - *Rapala iarbus*; 3 - *Mahathala ameria*; 4 - *Rapala varuna*; 5 - *Arhopala amantes*; 6 - *Zizina otis*; 7 - *Pseudozizeeria maha*; 8 - *Amblypodia anita*; 9 - *Spindasis vulcanus*. © Supriya Samanta



**Figure 4.** Total number of butterfly species and number of unique species (species recorded only from one particular site among the three study sites) recorded during different seasons.

71 species of butterflies from Ankua Reserve Forest, Jharkhand while Verma (2009) reported 39 butterfly species from Dalma Wildlife Sanctuary, Jharkhand. The present study, which covered much less area than the above mentioned studies, reports 54 species of butterflies. It is not unlikely that a few butterfly species may have escaped notice and will be added in the future. This study is therefore significant from the biodiversity and ecosystem aspects of this region. Very low species to genus ratio (1.38) was noticed in the present study which may be indicative of strong intra-generic competition (Elton 1946).

In the present study, Nymphalidae dominated

among the six families with respect to species richness which is in accordance with previous studies from similar eco-regions and vegetation types (Verma 2009; Singh 2010) as well as other regions of West Bengal (Sengupta et al. 2014; Mandal 2016) and different parts of India like northeastern India (Singh 2009, 2012; Kunte et al. 2012; Majumder et al. 2012), central India (Palot & Soniya 2003; Chandrakar et al. 2007; Singh 2010; Tiple 2011, 2012) and southern India (Kunte 1997; Arun 2002; Eswaran & Pramod 2005; Kumar et al. 2007; Murugesan et al. 2013). Apart from Riodinidae, Hesperidae was found to be the least abundant among the six families with only four recorded species of butterflies. This may be due to cryptic nature of most of the species in this family which make them very hard to spot and identify; however, this finding complies with the findings of Singh (2010) who studied butterfly diversity of moist deciduous sal forests of Ankua Reserve Forest, Koina Range, Saranda Division, West Singhbhum District, Jharkhand, India belonging to the same eco-region the Chota Nagpur Plateau. Interestingly, these two findings are contrary to most of the reports from other parts of the country. In the study of Mandal (2016) from Chinsurah, West Bengal, India, from Gorumara National Park, West Bengal, India and Majumder et al. (2012) from Tripura, India, Papilionidae was the least abundant species. This probably indicates that the climate and vegetation type of the present study area may not be suitable for the members of Hesperidae family. This, however, needs to be confirmed by further extensive



**Table 2. Family wise checklist with common and scientific names along with site and season of sighting and encounter frequencies of each butterfly species.**

	Common name	Scientific name	Site*	Season <sup>#</sup>	Encounter rates <sup>§</sup>
Family 1: Lycaenidae					
Subfamily: Polyommatae, Tribe: Polyommataini					
1.	Common Pierrot	<i>Castalius rosimon</i> (Fabricius, 1775)	1,2	2,3,4	C
Subfamily: Theclinae, Tribe: Deudorigini					
1.	Common Red Flash	<i>Rapala iarbus</i> (Fabricius, 1787)	2	4	R
2.	Indigo Flash	<i>Rapala varuna</i> (Horsfield, [1829])	2	4	R
Tribe: Arhopalini					
1.	Large Oakblue	<i>Arhopala amantes</i> (Hewitson, 1862)	2,3	2,4	C
2.	Falcate Oakblue	<i>Mahathala ameria</i> (Hewitson, 1862)	1,2	3,4	O
Tribe –Amblypodini					
1.	Purple Leaf Blue	<i>Amblypodia anita</i> Hewitson, 1862	1	1	R
Subfamily Polyommatae, Tribe: Polyommataini					
1.	Lesser Grass Blue	<i>Zizina otis</i> (Fabricius, 1787)	1,2, 3	1,2,3,4	W
2.	Pale Grass Blue	<i>Pseudozizeeria maha</i> (Kollar, [1844])	1,2	1,2,3,4	W
Subfamily: Aphnaeinae					
1.	Common Silverline	<i>Spindasis vulcanus</i> (Fabricius, 1775)	1	1,2	C
Family 2: Nymphalidae					
Subfamily: Limenitidinae, Tribe: Adoliadini					
1.	Common Baron	<i>Euthalia aconthea</i> (Cramer, [1777])	2	2	R
2.	Baronet	<i>Symphaedra nais</i> (Forster, 1771)	1,2,3	1,2,3,4	W
Tribe Limenitidini					
1.	Commander	<i>Moduza procris</i> (Cramer, [1777])	2	4	R
2.	Common Sailor	<i>Neptis hylas</i> (Linnaeus, 1758)	1,2,3	1,2,3,4	W
Subfamily: Calinaginae, Tribe: Charaxini					
1.	Black Rajah	<i>Charaxes solon</i> (Fabricius, 1793)	3	2	R
2.	Common Nawab	<i>Polyura athamas</i> (Drury, 1773)	2,3	3,4	R,O
Subfamily: Nymphalinae, Tribe: Junoniini					
1.	Blue Pansy	<i>Junonia orithya</i> (Linnaeus, 1758)	2,3	1,2,3,4	C
2.	Grey Pansy	<i>Junonia atlites</i> (Linnaeus, 1763)	1,2,3	1,2,3,4	W
3.	Lemon Pansy	<i>Junonia lemonias</i> (Linnaeus, 1758)	1,2,3	1,2,3,4	W
4.	Peacock Pansy	<i>Junonia almanac</i> (Linnaeus, 1758)	1,2,3	1,2,3,4	W

	Common name	Scientific name	Site*	Season <sup>#</sup>	Encounter rates <sup>§</sup>
5.	Chocolate Pansy	<i>Junonia iphita</i> (Cramer, [1779])	1,2,3	1,2,3,4	W
6.	Yellow Pansy	<i>Junonia hierta</i> (Fabricius, 1798)	1,2	1,2,3,4	W
Tribe: Kallimini					
1.	Great Eggfly	<i>Hypolimnas bolina</i> (Linnaeus, 1758)	2,3	2,3	C
Subfamily: Danaeinae, Tribe: Danaeini					
1.	Blue Tiger	<i>Tirumala limniace</i> (Cramer, [1775])	1,2	1,2,3,4	W
2.	Plain Tiger	<i>Danaus chrysippus</i> (Linnaeus, 1758)	1,2,3	1,2,3,4	W
3.	Striped / Common Tiger	<i>Danaus genutia</i> (Cramer, [1779])	1,2	1,2,3,4	C
Tribe: Euploeini					
1.	Common Crow	<i>Euploea core</i> (Cramer, [1780])	1,2,3	1,2,3,4	W
Subfamily: Satyrinae, Tribe: Satyrini					
1.	Common Bushbrown	<i>Mycalesis perseus</i> (Fabricius, 1775)	1	2,3	C
2.	Common Five-ring	<i>Ypthima baldus</i> (Fabricius, 1775)	1,2	1,3	O
3.	Common Four-ring	<i>Ypthima huebneri</i> Kirby, 1871	1	3	R
Tribe: Elymniini					
1.	Common Palmfly	<i>Elymnias hypermnestra</i> (Linnaeus, 1763)	1,2,3	1,2,3,4	C
Tribe: Melanitini					
1.	Common Evening Brown	<i>Melanitis leda</i> (Linnaeus, 1758)	1,2,3	1,2,3,4	W
Subfamily: Biblidinae, Tribe: Biblidini					
1.	Common Castor	<i>Ariadne merione</i> (Cramer, [1777])	1	2	R
Subfamily: Heliconiinae, Tribe: Heliconiini					
1.	Common Leopard	<i>Phalanta phalantha</i> (Drury, [1773])	1,2,3	2,3,4	C
Subfamily: Acraeinae, Tribe: Acraeini					
1.	Tawny Coster	<i>Acraea terpsicore</i> Fabricius, 1758	1,2	1,2,3,4	W
Family 3: Hesperidae					
Subfamily: Coeliadinae					
1.	Brown Awl	<i>Badamia exclamationis</i> (Fabricius, 1775)	2	2	O
Subfamily: Pyrginae, Tribe: Tagiadini					
1.	Common Snow Flat	<i>Tagiades jopetus</i> (Stoll, 1781)	2	3	R
Subfamily: Hesperinae, Tribe: Aeromachini					

	Common name	Scientific name	Site*	Season <sup>#</sup>	Encounter rates <sup>§</sup>
1.	Grass Demon	<i>Udaspes folus</i> (Cramer, [1775])	1	3	R
Tribe: Baorini					
1.	Parnara Swift	<i>Parnara sp.</i> (Moore, [1881])	1	3	C
Family 4: Pieridae					
Subfamily: Coliadinae					
1.	Common Emigrant	<i>Catopsilia pomona</i> (Fabricius, 1775)	1,2,3	1,2,3,4	W
2.	Mottled Emigrant	<i>Catopsilia pyranthe</i> (Linnaeus, 1758)	1,2	1,2	C
3.	Common Grass Yellow	<i>Eurema hecabe</i> (Linnaeus, 1758)	1,2,3	1,2,3,4	W
Subfamily Pierinae, Tribe: Pierini					
1.	Common Gull	<i>Cepora nerissa</i> (Fabricius, 1775)	1	2	C
2.	Common Jezebel	<i>Delias eucharis</i> (Drury, 1773)	1,2	1,3	C
3.	Psyche	<i>Leptosia nina</i> (Fabricius, 1793)	1,2	1,3	C
Tribe: Euchloeini					
1.	Common Wanderer	<i>Pareronia hippia</i> (Fabricius, 1787)	1,2,3	1,2,3,4	W
Family 5: Papilionidae					
Subfamily Papilioninae, Tribe: Papilionini					
1.	Blue Mormon	<i>Papilio polymnester</i> Cramer, [1775]	1,2	3	O
2.	Common Lime	<i>Papilio demoleus</i> Linnaeus, 1758	1,2,3	1,2,3,4	W
3.	Common Mime	<i>Papilio clytia</i> Linnaeus, 1758	1,2,3	1,2,3,4	W
4.	Common Mormon	<i>Papilio polytes</i> Linnaeus, 1758	1,2,3	1,2,3,4	W
Tribe: Leptocircini					
1.	Five-bar Swordtail	<i>Graphium antiphates</i> (Cramer, 1775)	3	2	R
2.	Spot Swordtail	<i>Graphium nomius</i> (Esper, 1799)	3	1	C
3.	Common Jay	<i>Graphium doson</i> (Felder & Felder, 1864)	3	2	C
Tribe: Troidini					
1.	Common Rose	<i>Pachliopta aristolochiae</i> (Fabricius, 1775)	1	1	R
Family 6: Riodinidae					
Subfamily: Riodininae, Tribe: Riodinini					
1.	Double-banded Judy	<i>Abisara bifasciata</i> Moore, 1877	2	4	R

\*Site: 1 = Baghmundi village area; 2 = Turga Dam area; 3 = Dauri Nala area

<sup>#</sup>Season: 1 = Summer (March to May), 2 = Monsoon (June to August), 3 = Post-monsoon (September to November), 4 = Winter (December to February)

<sup>§</sup>Status: W = Wide spread; C = Common; O = Occasional; R = Rare

survey in this region.

Among the three sites selected for the present study the maximum number of species (41) was recorded from site 2, the Turga Dam area which is a wetland area with swamps and bushes. Previous studies by Ghosh & Siddique (2005) and Chowdhury & Soren (2011) reported high butterfly diversity in same habitat types. The least number of butterflies was recorded from site 3, the Dowry Khal area. This is a rocky hill area with predominantly Sal (*Shorea robusta*) forest. Lack of plant diversity may be the reason behind low butterfly diversity in this region.

Butterflies were found to be more abundant during monsoon and post-monsoon seasons compared to summer and winter. This may be due to extreme climatic conditions of this region. Summer and winter are very dry as there is very little rainfall during these two seasons. Temperature varies from 2.8° in winter to 52° in summer causing dryness in moisture. This makes the climate unfavourable for butterflies during summer and winter as there are very few nectaring and larval food plants available during these two seasons. While moderate rainfall (1,100–1,500 mm) during monsoon favours plant growth which supports high butterfly diversity in the monsoon and post-monsoon seasons. Verma (2009) reported low butterfly diversity during summer from the same eco-region.

Though the present study is only a preliminary observation on the butterfly species diversity of the Baghmundi block, Purulia, West Bengal, it has some significance as it is the first reporting of butterfly fauna from this region and these can be used in monitoring ecosystem health, stability and functioning from the present study area. Conservation of these important pollinators is essential for sustainable development (Mandal 2016). Anthropogenic disturbances like cutting of trees from the forest, hunting and poaching are posing threats for the ecosystem and wildlife of this region. Therefore, further investigation on the biodiversity of this region covering more study areas may generate awareness among the local people and government authorities to save wildlife and their habitats.

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Image 5. Butterfly representing family Nymphalidae taken from three study sites.

- 1 - *Symphaedra nais*; 2 - *Charaxes solon*; 3 - *Junonia orithya*; 4 - *Tirumala limniace*; 5 - *Junonia iphita*; 6 - *Moduza procris*; 7 - *Euthalia aconthea*; 8 - *Mycalesis perseus*; 9 - *Ariadne merione*; 10 - *Melanitis leda*; 11 - *Ypthima baldus*; 12 - *Ypthima huebneri*; 13 - *Euploea core*; 14 - *Phalanta phalantha*; 15 - *Polyura athamas*; 16 - *Elymnias hypermnestra*; 17 - *Neptis hylas*; 18 - *Hypolimnas bolina* 19 - *Junonia atlites*; 20 - *Junonia lemonias*; 21 - *Junonia almana*; 22 - *Danaus chrysippus*; 23 - *Danaus genutia*; 24 - *Acraea terpsicore*; 25 - *Junoniahierta*.  
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Image 6. Butterfly representing family Hesperidae taken from three study sites.

- 1 - *Badamia exclamationis*; 2 - *Tagiades japetus*; 3 - *Udaspes folus*; 4 - *Parnara* sp. © Supriya Samanta.

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Image 7. Butterfly representing family Pieridae and family Riodinidae taken from three study sites.

1 - *Catopsilia pomona*; 2 - *Eurema hecabe*; 3 - *Cepora nerissa*; 4 - *Delias eucharis*; 5 - *Pareronia hippia*; 6 - *Catopsilia pyranthe*; 7 - *Leptosia nina* and 8 - family Riodinidae - *Abisara bifasciata*.

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Image 8. Butterfly representing family Papilionidae taken from three study sites.

1 - *Papilio polymnester*; 2 - *Graphium doson*; 3 - *Papilio demoleus*; 4 - *Papilio clytia*; 5 - *Papilio polytes*; 6 - *Graphium antiphates*; 7 - *Graphium nomius* 8- *Pachliopta aristolochiae*.

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ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

May 2017 | Vol. 9 | No. 5 | Pages: 10141–10248

Date of Publication: 26 May 2017 (Online & Print)

DOI: 10.11609/jott.2017.9.5.10141-10248

[www.threatenedtaxa.org](http://www.threatenedtaxa.org)

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