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Orthoptera Fauna, it's Habitat Ecology and Threats in Barnawapara Wildlife Sanctuary, Chhattisgarh, India

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Study Area: Barnawapara Wildlife Sanctuary
Coordinates: 21°18'45"N, 88°22'30"E to 21°30'N, 82°37'30"E
Key words: Acrididae, Orthopteran pest, Ecological habitat.

Abstract

In Nature inspite of serious floral damaging characteristic, Orthopteran insects also have some ecological and economical importance. In the present study we identified total 56 species of Orthopteran fauna representing 43 genera and 8 families are reported from different localities of Barnawapara Wildlife Sanctuary, Raipur, Chhattisgarh, India. Among which, nine species are new addition to the Chhattisgarh state reporting here with comprehensive account. Acrididae family represents maximum diversity and species richness (271), followed by Gryllidae (65), while the minimum number of species (3) was recorded from Tridactylidae family. Further, with respect to their habitat, the most appropriate seasons of their occurrences have been noted. The pest characteristics of newly noted species for the studied area have also been discussed.

Introduction

The Order- Orthoptera is one of the most diversified order of class Insecta. Orthopteran insects are also good food for mammals including man, birds, reptiles, amphibians and are often served as good bait for fishes and other animals present in the grassland and forests ecosystems. Besides its, insects of Order Orthoptera plays a major role in soil ecosystem by creating plant litter for the soil, stimulating plant growth and nutrients and cycling elements (Van Hook, 1971). Earlier, some notable taxonomical work on Orthopteran fauna from Chhattisgarh was carried out by few workers like Kirby, (1914), Chopard (1969; 1970), Dwivedi (1978), Dixit & Sinha (1982), Dwivedi (1990), Shishodia (1995, 2000), Chandra & Gupta (2005, 2011), Chandra *et al.* (2007), Gupta *et al.* (2008), Gupta (2009a,b, 2015), Gupta & Chandra (2010), Shishodia *et al.* (2010), Chandra (2014) and Skejo & Gupta (2015). And even Gupta &

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Chandra (2013) worked on Orthoptera fauna for Barnawapara wildlife Sanctuary and published 73 species pertaining to 62 genera under 8 families. The present study was started with a view to examine the diversity of Orthoptera and their habitat, ecology and seasonal occurance from Barnawapara Wildlife Sanctuary, Raipur.

Materials and Method:

Study area: Barnawapara Wildlife Sanctuary was established in 1976 under Wildlife Protection Act of 1972 and is located in Raipur district of Chhattisgarh, covering an area is about 244.66 sq.km. The topography of the region covers both the flat and hilly terrain with altitudes ranging between 215-800 mts. It is well known for its dense floral composition with unique wildlife habitats.

The specimens from the targeted areas were collected by sweeping over vegetation by insect net, and the larger specimens were picked up directly by hand or with the help of fine forceps. The specimens after collection from the field were killed in benzene or ethyl acetate in a killing bottle. For temporary storage in the field they were kept in insect envelopes. Some night active species were collected by installing light traps at different locations during night. The specimens were brought to laboratory and pinned, labeled and preserved for the identification. Survey site co-ordinates were recorded using GPS (Garmin Oregon 550). The identified specimens were deposited in National Zoological Collection, Zoological Survey of India, Kolkata.

Results and Discussion:

The present study handed us 526 specimens of Orthoptera from various habitats of the studied area (Table-1). The captured material included fifty six species belonging fourty three genera and eight families viz. Acrididae 26 species 20 genera, Pyrgomorphidae 3 species 3 genera, Tetrigidae 3 species 3 genera, Tridactylidae 1 species and 1 genus, Gryllidae 9 species 8 genera, Gryllotalpidae 3 species 1genus, Trigonidiidae 1 species 1 genus, Tettigoniidae 10 species 6 genera. The diversity and distribution of the species were seen to be greatly depending on abiotic as well as biotic factors. Abiotic factors like temperature, humidity and rainfall affect the population of Orthopteran fauna (Fig.-1).

We found 47% diversity of Orthopteran species were from the family Acrididae followed by Tettigoniidae 18%, Gryllidae 16%, Pyrgomorphidae 5%,Tetrigidae 5%,Gryllotalpidae 5%, Trigonidiidae 2% and Tridactylidae 2%.

The family Acrididae represents maximum diversity and species richness (271), followed by Gryllidae (65), Tetrigidae (53), Tettigoniidae (53), Pyrgomorphidae (38), Gryllotalpidae (35), Trigonidiidae (8), while the minimum number of species (3) was recorded from Tridactylidae family (Table 2).

Species Composition: During the study period a total of 56 species of Orthoptera belonging to 43 genera and 8 families were recorded (Table -2). Acrididae was the most dominant family of this order with 26 species followed by Tettigoniidae 10, Gryllidae 9, Pyrgomorphidae 3, Tetrigidae 3, Gryllotalpidae 3, Trigonidiidae1 and Tridactylidae 1.

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Table 1: Orthopteran insects collected from different habitats at Barnawapara WLS

S.N	Name of Species	Habitats	IR	%
	Family ACRIDIDAE			
l	*Acrida exaltata* (Walker, 1859)	Tall Grasses, Dense Forest, Agricultural lands-paddy fields, Near roadsides	7	1.33
2	*Acrida gigantea* (Herbst, 1794)	Dense Forest	18	3.42
3	*Acrida turrita* (Linnaeus,1758)	Thick grasses, bare land	5	0.95
4	*Phlaeoba infumata* Brunner, 1893	Scattered vegetation, Plains and hilly region	3	0.57
5	*Phlaeoba panteli* Bolivar, 1902	Dry Decidous Forest, scattered dry vegetations, barren land	1	0.19
6	*Diabolocatantops innotabilis* (Walker, 1870)	Dry Decidous forest, Roadsides	5	0.950
7	*Pachyacris vinosa* (Walker, 1870)	Woodland, Thicket	1	0.19
8	*Stenocatantops splendens* (Thunberg, 1815)	Woodland, Thicket	6	1.14
9	*Xenocatantops humilis humilis* (Serville, 1839)	Woodland, Thicket, Paddy fields	19	3.61
10	*Xenocatantops karnyi* (Kirby, 1910)	Green forest	10	1.90
11	*Eucoptacra praemorsa* (Stål, 1860)	Woodland, Thickets, Bushes	7	1.33
12	*Eucoptacra binghami* Uvarov, 1921 (*)	Woodland, Thickets, Bushes	3	0.57
13	*Aulacobothrus luteipes luteipes* (Walker, 1871)	Coarse grass and bushes, Paddy fields	12	2.28
14	*Crucinotacris decisa* (Walker, 1871) (*)	Coarse grass and bushes	2	0.38
15	*Clonacris kirbyi* (Finot, 1903)	Thicket grass, and mixed vegetation, Roadsides	4	0.76
16	*Hieroglyphus banian* (Fabricius, 1798)	Paddy field, sugarcane and fodder grass	1	0.19
17	*Aiolopus thalassinus tamulus* (Fabricius, 1798)	Green grasses, mixed vegetation, Roadsides	47	8.93
18	*Dittopternis venusta* (Walker, 1870)	Dry deciduous forest, bare land, hilly region	1	0.19
19	*Gastrimargus africanus africanus* (Saussure, 1888)	Dry deciduous forests, thickets grass, Wood-lands, Roadsides, mixed vegetation	12	2.28
20	*Heteropternis respondens* (Walker, 1859)	Wood lands, hilly region	2	0.38
21	*Morphacris fasciata* (Thunberg, 1815)	Wood lands, hilly region	3	0.57
22	*Oedaleus abruptus* (Thunberg, 1815)	Dry deciduous forests, Paddy fields,	15	2.85
23	*Trilophidia annulata* (Thunberg, 1815)	Dry deciduous and mixed forests, Paddy fields,	36	0.65
24	*Acrotylus humbertianus* Saussure, 1884	Paddy fields	1	0.19
25	*Heteracris pulcher* (Bolivar, 1902)	Dry deciduous forests, Paddy fields	1	0.19
26	*Spathosternum prasiniferum prasiniferum* (Walker, 1871)	Dry deciduous forests, Grasses, Paddy fields	61	11.59
	Family PYRGOMORPHIDAE			
27	*Aularches miliaris miliaris* (Linnaeus, 1758)	Decidous Forests, Mixed forests	2	0.38
28	*Atractomorpha crenulata* (Fabricius, 1793)	Green grasses, Dense forests, mixed vegetation	25	4.75
29	*Chrotogonus (Chrotogonus) trachypterus trachypterus* (Blanchard, 1836)	Woodlands, Bare lands, River bank	11	2.09
	Family TETRIGIDAE			
30	*Criotettix bispinosus* (Dalman, 1818)	Riparian area	2	0.38
31	*Euscelimena harpago* (Serville, 1839)	River bank associated with pebbles, sand	48	9.12
32	*Hedotettix gracilis* (de Haan, 1842)	Riparian area, Marshy lands	3	0.57
	Family TRIDACTYLIDAE			
33	*Tridactylus thoracicus* Guérin, 1844	Riparian area, Marshy lands	3	0.57
	Family GRYLLIDAE			
34	*Gryllodes sigillatus* (Walker, 1869)	Bare lands, mixed vegetation	6	1.14
35	*Gryllus (Gryllus) bimaculatus* De Geer, 1773	Bare lands, mixed vegetation, moist to dry broadleaf forest	2	0.38

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36	*Itaropsis tenella* (Walker, 1869) (*)	Dry forests, near leaf litter	5	0.95
37	*Modicogryllus (Modicogryllus) confirmatus* (Walker, 1859)	Dry forests, near leaf litter	17	3.23
38	*Phonarellus (Phonarellus) minor* Chopard, 1959	Dry forests, mixed vegetation	28	5.32
39	*Tarbinskiellus orientalis* (Burmeister, 1838)	Dry Forests, moist to dry broadleaf forest	4	0.76
40	*Tarbinskiellus portentosus* (Lichtenstein, 1796)(*)	Dry Forests, moist to dry broadleaf forest	1	0.19
41	*Oecanthus indicus* Saussure, 1878	Leaf litter and mixed vegetation, moist to dry broadleaf forest	1	0.19
42	*Dianemobius fascipes* (Walker,1869)	Marshy fields, short grasses in wet habitat	1	0.19
	Family GRYLLOTALPIDAE			
43	*Gryllotalpa africana* Beauvois, 1805	Marshy fields	30	5.70
44	*Gryllotalpa ornata* Walker, 1869 (*)	Marshy fields	2	0.38
45	*Gryllotalpa hirsuta* Burmeister, 1838 (*)	Marshy fields	1	0.19
	Family TRIGONIDIIDAE			
46	*Trigonidium (Trigonidium) cicindeloides* Rambur, 1839	Marshy fields	8	1.52
	Family TETTIGONIIDAE			
47	*Conocephalus (Anisoptera) maculatus* (Le Guillou, 1841)	Riparian area, Long grasses, mixed vegetation	13	2.47
48	*Elimaea (Orthelimaea) securigera* Brunner von wattenwyl, 1878	Long grasses, hilly area	6	1.14
49	*Himertula kinneari* (Uvarov, 1923)	Long grasses, hilly area	9	1.71
50	*Letana bulbosa* Ingrisch, 1990 (*)	Long Grasses, hilly area	1	0.19
51	*Letana intermedia* Ingrisch,1990	Long Grasses, hilly area	6	1.14
52	*Letana inflata* (Brunner von Wattenwyl, 1878)(*)	Long grasses, hilly area, mixed vegetation	1	0.19
53	*Letana infurcata* Ingrisch, 1990 (*)	Long grasses, hilly area	2	0.38
54	*Letana megastridula* Ingrisch, 1990	Long Grasses, hilly area, mixed vegetation	1	0.19
55	*Phaneroptera gracilis* Burmeister,1838	Long grasses, hilly area, mixed vegetation	2	0.38
56	*Hexacentrus unicolor* Serville, 1831	Long grasses, hilly Area, mixed vegetation	2	0.38
		Total	**526**	**100**

Table 2. Familywise total number of species and its individuals and their percent contribution to total number of species and individuals observed during study period.

S. No.	Families	No. of Species	%	No. of Individuals	%
1	Acrididae	26	46.43	271	52.83
2	Pyrgomorphidae	3	5.36	38	7.41
3	Tetrigidae	3	5.36	53	10.33
4	Tridactylidae	1	1.79	3	.58
5	Gryllidae	9	16.07	65	12.67
6	Gryllotalpidae	3	5.35	35	6.24
7	Triginidiidae	1	1.79	8	1.56
8	Tettigoniidae	10	17.85	53	8.38
	Total	56	100	526	100

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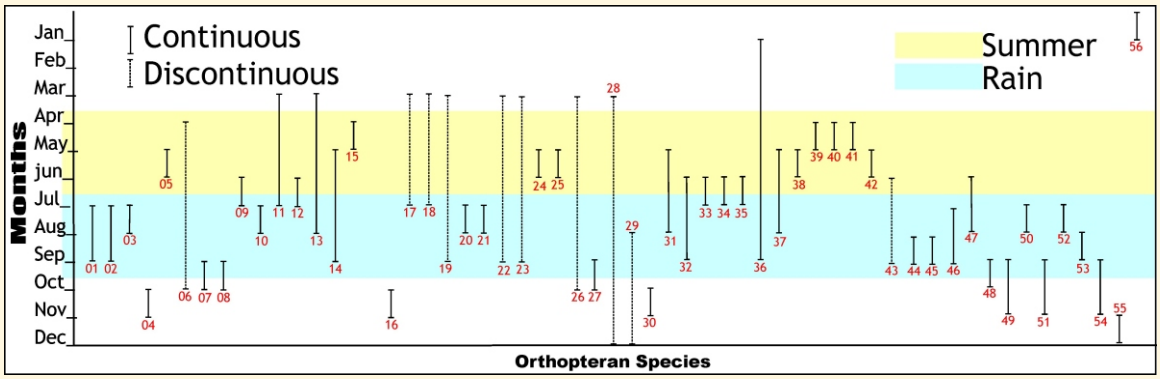

Figure- 1: Season of tentative occurance of the Orthopteran species in the Barnawapara WLS.

Species: 1)*A. exaltata*, 2)*A. gigantea*, 3)*A. turrita* 4)*P. infumata*, 5)*P. panteli,* 6)*D. innotabilis,* 7)*P. vinosa,* 8)*S. splendens,* 9)*X. humilis,* 10)*X. karnyi,* 11)*E. praemorsa,* 12)*E. binghami*, 13) *A. luteipes,* 14)*C. decisa,* 15)*C. kirbyi,* 16) *H. banian,* 17)*A. thalassinus,* 18)*D. venusta,* 19)*G. a.africanus,* 20)*H. respondens,* 21)*M. fasciata,* 22)*O. abruptus,* 23)*T. annulata,* 24)*A. humbertianus,* 25)*H. pulcher,* 26) *S. p.prasiniferum,* 27)*A. m.miliaris,* 28) *A. crenulata* 29)*C. t.trachypterus,* 30)*C. bispinosus,* 31)*E. harpago,* 32)*H. gracilis,* 33)*T. thoracicus,* 34)*G. sigillatus,* 35)*G. bimaculatus,* 36)*I. tenella,* 37)*M. confirmatus,* 38)*P. minor,* 39)*T. orientalis,* 40)*T.portentosus*, 41)*O. indicus,* 42)*D. fascipes,* 43)*G. africana,* 44)*G. ornata,* 45)*G. hirsuta,* 46)*T. cicindeloides,* 47)*C. maculatus,* 48)*E. securigera,* 49)*H. kinneari,* 50)*L. bulbosa,* 51)*L. intermedia,* 52)*L. enflata,* 53)*L. infurcata,* 54)*L. megastridula,* 55)*P. gracilis,* 56)*H. unicolor*

Systematic Accounts of the Species Recorded for the time from the State

Order ORTHOPTERA
Suborder CAELIFERA
Infraorder ACRIDIDEA
Superfamily ACRIDOIDEA
Family ACRIDIDAE
Subfamily COPTACRIDINAE
Genus *Eucoptacra* Bolivar, 1902

1. *Eucoptacra binghami* Uvarov, 1921 (*)

1921. *Eucoptacra binghami* Uvarov, Ann. Mag. nat. Hist. London, 7 (9) : 503.
2000. *Eucoptacra binghami*, Shishodia & Tandon, State Fauna Series,7: Fauna of Tripura-II, Zool. Surv. India, : 205.
Material examined: Chhattisgarh; Raipur, Barnawapara WLS, Barnawapara, 19.vii.2011, 2(♀,NC); Dongpahari, 4.vii.2011, 1(♀,DC) coll. S. K. Gupta & Party.
Distribution: India; Chhattisgarh (Raipur), Kerala, Meghalaya, Manipur, Nagaland and Tripura. Elsewhere: Malaysia, Myanmar, Thailand and Tonking.

Subfamily GOMPHOCERINAE
Genus *Crucinotacris* Jago, 1996

2. *Crucinotacris decisa* (Walker, 1871) (*)

1871. *Stenobothrus decisus* Walker, Cat. Derm. Salt. Brit. Mus., 5: 80.
1996. *Crucinotacris decisa*, Jago, Jour. Orth. Res., 5: 75.
Material examined: Chhattisgarh; Raipur, Barnawapara WLS, Barnawapara, 18.vii.2011, 1(♂,NC); 29.vii.2011, 1(♀,NC) coll. S. K. Gupta & Party.
Distribution: India; Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh (Raipur), Delhi, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Orissa, Sikkim, Tamil Nadu, Tripura, West Bengal. Elsewhere: China, Europe, Japan, Myanmar, North America and Pakistan.

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Suborder ENSIFERA
Superfamily GRYLLOIDEA
Family GRYLLIDAE
Subfamily GRYLLINAE
Genus *Itaropsis* Chopard, 1925

3. *Itaropsis tenella* (Walker, 1869) (*)

1869a. *Gryllus tenellus* Walker, Cat. Derm. Salt. Brit. Mus.,: 37.
1995. *Itaropsis tenellus*, Tandon & Shishodia, Himalayan Ecosystem Series: Fauna of Western Himalaya (U.P.)-I, Zool. Surv. India,: 40.
1998. *Itaropsis tenellus*, Schmidt, J. Ent. Res. Soc., 1(1): 43.
Material examined: Chhattisgarh; Raipur, Barnawapara WLS, Barnawapara, 4.ix.2011, 1(♂,DC); Bafra, 10.i.2012, 1(♂,NC); Furfundi, 12.vii.2013, 1(♂, DC) coll. S. K. Gupta & Party.
Distribution: India: Chhattisgarh (Raipur), Goa, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Pondicherry, Tamil Nadu, Uttarakhand and West Bengal. Elsewhere: Malaysia and Sri Lanka.

Genus *Tarbinskiellus* Gorochov, 1983

4. *Tarbinskiellus portentosus* (Lichtenstein, 1796) (*)

1796. *Acheta portentosa* Lichtenstein, Cat. Mus. Zool. Hamburg, 3 : 86.
2008. *Tarbinskiellus portentosus*, Buzzetti & Devriese, Boll. Mus. civ. St. nat. Verona, 32: 162.
Material examined: Chhattisgarh; Raipur, Barnawapara WLS, Barnawapara Camp, 14.vi.2012, 1(♂,NC) coll. S. K. Gupta & Party.
Distribution: India; Arunachal Pradesh, Assam, Bihar, Chhattisgarh (Raipur), Delhi, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Nagaland, Orissa, Punjab, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal. Elsewhere: Bangladesh, China, Indonesia, Java, Malaysia, Myanmar, Philippines, Singapore and Taiwan.

Family GRYLLOTALPIDAE
Genus *Gryllotalpa* Latreille, 1802

5. *Gryllotalpa ornata* Walker, 1869 (*)

1869. *Gryllotalpa ornata* Walker, Cat. Derm. Salt. Brit. Mus., : 5.
2002. *Gryllotalpa ornata*, Ingrisch, Entomologica Basiliensia, 24: 148.
Material examined: Chhattisgarh, Raipur, Barnawapara WLS; Turturia Forest, 8.vii.2013, 2(♂,♀,DC) coll. S.K. Gupta & Party.
Distribution: India- Assam, Chhattisgarh (Raipur), Sikkim, Uttarakhand, Uttar Pradesh and West Bengal. Elsewhere- Bhutan.

6. *Gryllotalpa hirsuta* Burmeister, 1838 (*)

1838. *Gryllotalpa hirsuta* Burmeister, Handb. Ent., 2: 739.
2000. *Gryllotalpa hirsuta*, Shishodia, State Fauna Series, 7: Fauna of Tripura- II, Zool. Surv. India,: 248.
Material examined: Chhattisgarh- Raipur, Barnawapara WLS, Barnawapara, 1.x.2011, 1(♀,DC) coll. S.K. Gupta & Party.
Distribution: India- Chhattisgarh (Raipur), Tripura. Elsewhere- Borneo, Java, Malaysia, Selangor, Singapore and Sumatra.

Superfamily TETTIGONIOIDEA
Family TETTIGONIIDAE
Subfamily PHANEROPTERINAE
Genus *Letana* Walker, 1869

7. *Letana bulbosa* Ingrisch, 1990 (*)

1990. *Letana bulbosa* Ingrisch, Entomologica Scandinavica, 21(3) : 254.
2000. *Letana bulbosa*, Ingrisch & Shishodia, Mitt. Münch. Ent. Ges., 90 : 16.
Material examined: Chhattisgarh- Raipur, Barnawapara WLS; Achanakpur, 31.vii.2011, 1(♂,DC) coll. S.K. Gupta & Party.

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Distribution: India- Chhattisgarh (Raipur), Kerala, Karnataka, Pondicherry, Tamil Nadu and West Bengal.

8. *Letana inflata* (Brunner von Wattenwyl, 1878) (*)

1878. *Pyrrhicia inflata* Brunner von Wattenwyl, Monographie der Phaneropteriden: 116.
1990. *Letana inflata*, Ingrisch, Entomologica Scandinavica, 21(3): 253.
Material examined: Chhattisgarh- Raipur, Barnawapara WLS; Keduva nala, 9.vii.2011, 1(♀,DC) coll. S. K. Gupta & Party.
Distribution: India- Chhattisgarh (Raipur), Delhi and Tamil Nadu. Elsewhere- Sri Lanka.

9. *Letana infurcata* Ingrisch, 1990 (*)

1990. *Letana infurcata* Ingrisch, Ent. Scand., 21 (3) : 249.
2007. *Letana infurcata*, Chandra et. al., Zoos' Print Journal, 22 (5): 2684.
Material examined: Chhattisgarh- Raipur, Barnawapara WLS; Bafra, 22.vii.2011, 1(♀,DC); Barnawapara, 1.viii.2011, 1(♂,DC) coll. S. K. Gupta & Party.
Distribution: India- Chhattisgarh (Raipur), Madhya Pradesh, Pondicherry and Tamil Nadu.

Abbreviation: WLS: Wildlife Sanctuary; DC: Day collection; NC: Night collction.; coll. : Collector.

Conclusion:

The Orthopteran insects are found to have the scientific, ecological and economic importance. Nevertheless, many species are serious pests of crops, forests and pastures. Inspite of the earlier threatened Orthopetran insects reported from the studied area, few reported dangerous pests have also been identified from the 9 new species which we were observed for the first time.

As per Kalia & Lal (1999) *Tarbinskiellus portentosus* is a harmful pest for *Dalbergia sisso* and other common forest species (Ali & Chaturvedi, 1996) which are the most common forest species for the Chhattisgarh region. In addition, *Tarbinskiellus portentosus* is also reported to affect various agricultural species like groundnut, sesame, sunflower and canola in Myanmar (Morris & Waterhouse, 2001). Another noted defoliater species identified by us in the studied area was *Letana inflata* which is a noted pest for sandalwood plants (Remadevi *et al.*, 2005; Wylie & Speight, 2012). In addition, it was also reported to be harmful for the crops of ginger and turmeric (Nair, 2013). However, both of these insects were noticed during rain represented by only one specimen in each case, thus its harmful effects could not be predicted at the present status.

Gryllotalpa hirsuta, a serious swidden pest of Indonesia mostly eat root of the rice plant (Dove, 1985) and potatoes (Setiawati *et al.,* 2015) was also identified from a marshy place represented by only one specimen. It generally lives inside the ground, feed on humus and roots. However, we have found only a single specimen from a marshy place and thus its any type of affect of the ecology could not be predicted at this stage.

In the recent years the developmental activities by human, mostly affected the grasslands and scrub forest area of Barnawapara Wildlife sanctuary involved more or less intensive deforestation, extended cultivation and road construction which exerted profound influence on the entire hitherto undisturbed ecosystems. The intrusion of man into the habitats of Orthoptera while cultivating virgin lands, decline of grassland habitat generally leads to a considerable reduction in the number of species and individuals mostly grasshoppers. This

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Figure- 2: Two new records- a) *Tarbinskiellus portentosus; b) Gryllotalpa hirsuta*

could be the reason that they are attacking the crop fields due to lack of their natural habitat (Tandon & Hazra, 1998). Therefore, it should be taken to conserve the grassland areas for the protection of threatened animals. There is great need to do a lot in the protection and conservation of these fauna. The general public needs to be educated about the utility of our heritage in the form diversity of flora and fauna.

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