A COMPENDIUM ON MUSHROOM MITES IN INDIA

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Abstract

The present compendium provides a list of mites occurring both on edible (4 spp.) and wild mushrooms (26 spp.), collected mainly from West Bengal and a few from Kerala. A total of 106 species, under 68 genera, 43 families and 4 orders are reported. Of those, 64 species of mites are represented on edible mushrooms and 57 species of mites are represented on wild mushrooms. This list includes 6 spp. as likely new to science, to be described later, 4 spp. which are hitherto unreported from India and 8 spp. as new occurrence on mushrooms from India. All the species are arranged taxonomic category-wise, giving information regarding their relative abundance and the nature of association with both edible and wild mushrooms. Out of 106 spp., 33 species cause damage, 56 are predators and 16 are of unknown association.

Introduction

Mushrooms on one hand are important components for sustainability of ecosystems and, on the other hand, are of economic importance both for edible and medicinal purposes. Some are parasitic and there are some which may prove to be fatal, if consumed by human beings. Mushroom cultivation is gaining importance day by day because of their manifold uses nowadays. Many mushroom cultivators in West Bengal, especially women, are earning substantially through selling them.

Mushrooms, which can be broadly categorized under 2 groups *viz*. edible and wild, and both are attacked by pests which include insects, mites and nematodes that cause economic loss to the mushroom growers. So far as mites occurring on mushrooms are concerned, not much has been explored from most parts of India. Some of the important publlications are Das (1986), Somchoudhury *et al*. (1987) and Das *et al*. (1987, 1987a, 1988, 1989, 1993). Gupta (2012) provided summarized information of 17 species under 9 genera known till that time from India. Thereafter, Gupta & Pal (2017), Aiswarya *et al*. (2018), Parveen & Gupta (2019, 2020), Mondal & Gupta (2019) provided additional information. Since most of the available information regarding mites of mushrooms is scattered and not accessible to many, it was thought desirable to provide an updated list of mites on mushrooms in India giving all the information available till date.

This list includes 106 species and 68 genera under 43 families and 4 orders from both edible and wild mushrooms. It includes 6 species which appear to be new to science (to be described later), 4 species hitherto unreported from India and also 8 species, which were not known to occur on mushrooms. Apart from listing these species, their relative abundance, the mushroom species on which they had been reported with the nature of association have also been provided.

Materials & Methods

The present compendium of mushroom mites is based mostly upon collections of mites on both edible and wild mushrooms made by the authors from West Bengal (Parveen & Gupta 2019, 2020; Mondal & Gupta, 2019). Besides, other published information available to the authors was also included on this list.

Results and Discussion

Table-1 lists a total of 106 species of mites belonging to 68 genera and 43 families under 4 orders. Of those, 64 species, 51 genera, 28 families, 3 orders have been reported on edible mushrooms and the corresponding figures for wild mushrooms were 57 species, 48 genera, 32 families and 4 orders, respectively. There were many species which were recorded on both types of mushrooms. The present work reports 6 species likely to be new *viz*. *Typhlodromous*-4 spp., *Neocunaxoides*- 1 sp., *Cheylostigmaeus*-1sp.. In addition, 4 species (marked with a single asterisk in Table-1), *viz*. *Charletonia rocciai, Typhlodromous (Anthoseius) egypticus, Hypoaspis lubrica, Macrocheles glaber* were not hitherto reported from India and 8 species (indicated by double asterisks in Table-1) were not reported to occur on mushrooms in India.

Among the mite species, 27 species under 9 families and 3 orders were damage causing in the case of edible mushrooms while corresponding figures for wild mushrooms were 13 species under 5 families and 2 orders. *Acarus siro* and *Tyrophagus putrescentiae* caused damage on edible mushrooms (*Pleurotus* spp.) and *Suidasia nesbitti* and *Tyrophagus putrescentiae* caused damage on wild mushrooms (*Pseudohydnum gelatinosum* and *Chlorophyllum hortense*). As a result of infestation, the mushrooms had shown damage symptoms like blackening of the straw bed, browning of spore-caps and making the stalks hollow, etc.

As far as predatory mites are concerned, the most dominant mites belonged to order Mesostigmata (families Veigaidae, Parasitidae, Ascidae) on edible mushrooms and Ascidae on wild mushrooms. Among Prostigmatid mites, the dominant ones belonged to Cheyletidae (in case of wild mushrooms) and Pyemotidae on edible mushrooms. The predatory mites mostly devoured mites belonging to Acaridae and Suidasiidae. The other 16 mite species reported here were under 16 genera, 14 families and 3 orders and all those were fungal feeding in nature, belonging to Prostigmata (Raphignathidae, Caligonellidae), Mesostigmata (Uropodidae, Resinacaridae) and Oribatida (Galumnidae, Ceratozetidae, Trhypochthoniidae, Oppiidae, Oribatulidae and Austrachipteriidae). It may be mentioned here that oribatid mites were also predominant in some mushrooms.

Through a series of papers, Das (1986), Das *et al*. (1987, 1987a, 1989, 1993) contributed extensively to knowledge of the diversity of mushroom mites along with their bio-ecology and control. Somchoudhury *et al*. through a series of papers (1983-1989) also enriched our knowledge on mushroom mites. Recently, Aiswarya *et al.* (2018) reported 14 species under 18 genera, 12 families, and 3 orders mostly on wild mushroom from Kerala, while Mondal & Gupta (2019) reported 12 species under 10 families on edible mushrooms from West Bengal.

Relative abundance: X= Highly abundant (> 10 specimens/ gram of sample)

Y= Occasional occurrence (>5 specimens but <10 specimens/ gram of sample)

Z= Rare occurrence (<5 specimens/ gram of sample)

Edible mushrooms: 1= *Calocybe indica*, 2= *Pleurotus* spp. (*ostreatus*, *djamor*, *sajor-caju*), 3= *Volvariella volvacea*, 4= *Agaricus bisporus.*

Wild mushrooms: 5= *Chlorophyllum hortense*, 6= *Copalandia cyanescens,* 7=*Crepidotus applanatum,* 8= *Laccaria laccata*, 9= *Ganoderma lucidum,* 10= *Inocybe umbonata,* 11= *Russula kanadii,* l2= *Pseudohydnum gelatinosum,* 13= *Earliella scabrosa,* 14= *Auricularia auricular,* 15= *Coriolopsis occidentalis,* 16= *Russula albonigra,* 17= *Undetermined,* 18= *Ternitomyces* sp., 19= *Lentinus squarrosulus*, 20= *Chlorophyllum molybidites*, 21= *Stereum* sp., 22=*Lenzites* sp., 23= *Marasmius haematocephalus*, 24= *Scleroderma* sp., 25= *Strobilomyces strobilaceus*, 26= *Phlebopus* sp., 27= *Russula congoana*, 28=*Mycena* sp.,

29= *Ganoderma* sp., 30= *Volvariella nigrodisca*, 31=*Dictyophora* sp.
*= New report from India
**= New report on mushroom from India

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References

Aiswarya, M., S.K. Gupta & S.P. James. 2018. A preliminary report on Acari inhabiting in different mushrooms of Western Ghats, Calicut, Kerala. *Uttar Pradesh J. Zool*. 38(1): 15-19.

Das, P. 1986. *Bionomics and control of mushroom mites.* Ph.D. thesis. B.C. Agr. Univ., Kalyani: 1-197.

Das, P., A.K. Somchoudhury & A.B. Mukherjee. 1987. Nature and habitat of mushroom mites. *Env.Ecol.* 5(4): 677-680.

Das, P., A.K. Somchoudhury, A.B. Mukherjee & P.K. Sarkar. 1987a. Some aspects of feeding behavior of mushroom mites. *Abst. First Nat. sem. Acar, BCK., Kalyani,* 29-31 Oct., 1987: 24.

Das, P., A.K. Somchoudhury & A.B. Mukherjee. 1988. Source of mite infestation in mushroom. *Env.Ecol.* 6(3): 669-671.

Das, P., A.K. Somchoudhury & A.B. Mukherjee. 1989. Seasonal incidence and assessment of loss caused by mite complex on some cultivated species of mushroom. *Progress in Acarology,* 2: 215-221.

Das, P., A.K. Somchoudhury, A.B. Mukherjee & P.K. Sarkar. 1993. Some aspects of feeding behavior of mushroom mites. In. *Acarological Researches in India* (Eds. A.K. Somchoudhury, A.B.Mukherjee, & Sarkar, P.K.): 271-282.

Gupta, S.K. 2012. *Handbook Injuries and beneficial mites infesting agri-horticultural crops in India and their management,* Nature Books India, New Delhi. 1-362.

Hill, A. & K.L. Deahl. 1978. Description and life cycle of a new species of *Histiosoma* (Acari: Histiostomatidae) associated with commercial mushroom production. *Proc. Entom. Soc. Wash*. 80: 317-329.

Mondal, A. & S.K. Gupta. 2019. Insects and mites occurring on mushroom in South 24 Parganas district of West Bengal. *Int. J. Sci. Res.* 8(2): 67-69.

Mukherjee, A.B. & A.K. Somchoudhury. 1974. Mite pests of mushrooms. FAO *Pl. Prot. Bull.* 22(2): 51.

Parveen, R. & S.K. Gupta. 2019. Some new records of mites occurring in mushroom in South Bengal. *Int. J. Zool. Studies* 4 (5): 8-12.

Parveen, R. & S.K. Gupta. 2020. Diversity of mites (Acari) on wild mushrooms from West Bengal. *Int. J.Agri. & Plant Sci.* 2(1): 1-07.

Somchoudhury, A.K. & A.B. Mukherjee. 1988. Source of mite infesting in mushroom cultivation. *Env. Ecol.* 6(3): 669-671.

Trivedi, T.P. 1988. Occurrence of mites in the beds of cultivated mushroom. Univ. Agri. Sci. Bangalore. *Curr. Res.* 17(9): 125.

Table 1: List of mites both from edible/ wild mushrooms from India with respective hosts/ habitats, relative abundance and nature of association with mushroom species.

Sl. No.	Mites Species			Relative abundance	Edible mushroom (1-4)	Wild mushroom (5-31)	Damage causing	Predator	Others	References
	Order\ Suborder	Family	Species							
1	Sarcoptiformes: Suborder- Oribatida: Cohort-Astigmata	Acaridae	*Acarus siro* Linn.	X	+	+	+	-	-	Parveen & Gupta, 2019 Parveen & Gupta, 2020 Aiswarya *et al*.,2018
2			*Acarus gracilis* Hughes	Z	+	-	+	-	-	Parveen & Gupta, 2019
3			*Acarus farris* Oudemans	Z	+	+	+	-	-	Parveen & Gupta, 2020
4			*Tyrophagus dimidiatus* Hermann	Y	+	-	+	-	-	Gupta, 2012 Das *et al*., 1987 Somchoudhury & Mukherjee, 1988
5			*Tyrophagus berlesei* Michael	Z	+	-	+	-	-	Gupta, 2012
6			*Tyrophagus putrescentiae* Schrank	X	+	+	+	-	-	Gupta, 2012 Parveen & Gupta, 2019 Parveen & Gupta, 2020 Aiswarya *et al*., 2018 Mukherjee & Somchoudhury, 1972
7			*Tyrophagus longior* Gervais	Z	+	+	+	-	-	Parveen & Gupta, 2019 Parveen & Gupta, 2020 Aiswarya *et al*., 2018

8			*Tyrophagus perniciosus* Zachvatkin	Z	-	+	+	-	-	Mukherjee & Somchoudhury, 1974
9			*Rhizoglyphus echinopus* Fumouze and Robin	X	+	-	+	-	-	Gupta, 2012 Parveen & Gupta, 2019 Somchoudhury & Mukherjee, 1988 Das *et al*. 1987, 1988, 1989
10			*Rhizoglyphus robini* Claparede	Y	+	-	+	-	-	Parveen & Gupta, 2019
11			*Caloglyphus oudemansi* Zachvatkin	Z	+	-	+	-	-	Parveen & Gupta, 2019
12			*Caloglyphus mycophagus* Megnin	Z	+	-	+	-	-	Gupta, 2012
13			*Caloglyphus berlesei* Michael	Z	+	-	+	-	-	Parveen & Gupta, 2019
14			*Caloglyphus hughesi* Samsinak	Z	-	+	+	-	-	Aiswarya *et al*., 2018
15		Histiostomidae	*Histiostoma heinemanni* Hill & Diahl	Z	+	-	+	-	-	Gupta, 2012 Das *et al*., 1987, 1989 Somchoudhury & Mukherjee, 1988
16			*Histiostoma ferroniarum* Dufour	X	+	+	+	-	-	Aiswarya *et al*., 2018 Parveen & Gupta, 2019 Parveen & Gupta, 2020
17			*Histiostoma gracilipis* Banks	Z	+	-	+	-	-	Gupta, 2012 Hill & Deahl, 1978
18			*Histiostoma sapromyzarum* Dufour	X	+	+	+	-	-	Parveen & Gupta, 2019 Parveen & Gupta, 2020
19		Glycyphagidae	*Glycyphagus domesticus* De Geer	X	+	-	+	-	-	Aiswarya *et al*., 2018 Parveen & Gupta, 2019
20			*Glycyphagus bicaudatus* Hughes	Z	+	-	+	-	-	Parveen & Gupta, 2019
21			*Glycyphagus ornatus* Kramer	Z	-	+	+	-	-	Aiswarya *et al*., 2018

22			*Austroglycyphagus geniculatus* Vitzthum	Z	-	+	+	-	-	Parveen & Gupta, 2020
23			*Lepidoglyphus destructor* Schrank	X	-	+	+	-	-	Aiswarya *et al*., 2018 Parveen & Gupta, 2019 Parveen & Gupta, 2020
24		Suidasiidae	*Suidasia nesbitti* Sasa	X	+	+	+	-	-	Parveen & Gupta, 2019 Parveen & Gupta, 2020
25	iformes: Suborder-Prostigmata	Tarsonemidae	*Tarsonemus granarius* Lindquist	Z	-	+	+	-	-	Parveen & Gupta, 2020
26			*Tarsonemus myceleiphagus* Austin & Jary	Z	+	-	+	-	-	Gupta, 2012
27			*Tarsonemus confusus* Ewing	Z	+	-	+	-	-	Gupta, 2012
28			*Tarsonemus tarsalis* Canestrini	Z	+	-	+	-	-	Gupta, 2012
29		Pygmephoridae	*Pygmephorus selinicki* Krczal	Z	+	-	+	-	-	New report
30			*Pygmephorus fletchmanni* Wicht	Z	+	-	+	-	-	New report
31		Dolichocybidae	*Dolichocybe keiferi* Krantz	Y	+	-	+	-	-	New report
32		Scutacaridae	******Scutacarus baculitarsus* Norton & Ide	Z	+	-	+	-	-	New report
33		Tydeidae	*Tydeus collyerae* Baker	X	+	-	-	+	-	Parveen & Gupta, 2019
34			******Tydeus gosabaensis* Gupta	Z	-	+	-	+	-	New report
35			******Lorrya stricta* Gupta	Z	+	-	-	+	-	New report
36		Raphignathidae	*Raphignathus* sp.	X	+	-	-	-	+	Parveen & Gupta, 2019
37		Pyemotidae	*Pyemotes herfsi* Oudemans	X	+	-	+	-	-	Parveen & Gupta, 2019
38		Caligonellidae	*Neognathus* sp.	Z	+	-	-	-	+	Parveen & Gupta, 2019

39		Cunaxidae	*Neocunaxoides* sp.n.	Z	+	-	-	+	-	Parveen & Gupta, 2019
40			*Cunaxoides biscutum* Nesbitt	Z	-	+	-	+	-	Parveen & Gupta, 2020
41		Tenuiepalpidae	*Brevipalpus euphorbiae* Mohanasundarum	Z	-	+	-	-	+	Parveen & Gupta, 2020
42		Cheyletidae	*Cheyletus eruditus* Schrank	Y	+	+	-	+	-	Parveen & Gupta, 2020
43			*Cheyletus audex* Oudemans	Y	-	+	-	+	-	Parveen & Gupta, 2020
44			*Eucheyletia sinensis* Volgin	Z	-	+	-	+	-	Parveen & Gupta, 2020
45			*Chelacaropsis moorei* Baker	Z	-	+	-	+	-	Parveen & Gupta, 2020
46		Iolinidae	******Pronematus fleschneri* Baker	Z	-	+	-	-	+	New report
47		Stigmaeidae	*Cheylostigmaeus* sp.n.	Z	-	+	-	+	-	Parveen & Gupta, 2020
48		Erythraeidae	*****Charletonia rocciai* Treat & Flechtmann	Z	-	+	-	+	-	New report
49	Mesostigmata	Blattisociidae	*Lasioseius quadrisetosus* Chant	X	+	-	-	+	-	Parveen & Gupta, 2019
50			*Lasioseius floridensis* Berlese	X	-	+	-	+	-	Parveen & Gupta, 2020
51			******Lasioseius parberlesei* Bhattacharya	Z	-	+	-	+	-	New report
52			*Lasioseius mcgregori* Chant	Z	-	+	-	+	-	Parveen & Gupta, 2020
53			*Lasioseius formosus* Westerboer	Z	-	+	-	+	-	Aiswarya *et al*., 2018
54			*Lasioseius penicilliger* Berlese	Y	+	+	-	+	-	Aiswarya *et al*., 2018
55		Ascidae	*Zercoseius spathuliger* Leonardi	Z	-	+	-	+	-	Parveen & Gupta, 2020
56			******Asca biswasi* Bhattacharyya	Z	+	-	-	+	-	New report
57			*Asca garmani* Hurlbutt	Z	-	+	-	+	-	Parveen & Gupta, 2020
58			*Antennoseius indicus* Bhattacharyya	Y	+	-	-	+	-	Parveen & Gupta, 2019
59			*Gamasellodes bicolor* Berlese	Y	+	+	-	+	-	Parveen & Gupta, 2020
60			*Cheiroseius laelaptoides* Berlese	Z	-	+	-	+	-	Parveen & Gupta, 2020
61			*Platyseius subglaber* Berlese	Z	-	+	-	+	-	Parveen & Gupta, 2020

62		Melicharidae	*Proctolaelaps pygmaeus* Muller	Z	-	+	-	+	-	Aiswarya et al., 2018
63		Parasitidae	*Parasitus assamensis* Bhattacharyya	X	+	-	-	+	-	Parveen & Gupta, 2019
64			*Parasitus consanguineus* Oudemans & Voigts	X	+	-	-	+	-	Parveen & Gupta, 2019 Trivedi, 1988
65			*Parasitus shillongensis* Bhattacharyya	X	-	+	-	+	-	Parveen & Gupta, 2020
66			******Pergamasus primitivus* Oudemans	Z	+	-	-	+	-	New report
67			*Pergamasus crassipes* Berlesei	Z	+	-	-	+	-	Parveen & Gupta, 2019
68			*Pseudoparasitus* sp.	Z	-	+	-	+	-	Aiswarya *et al*., 2018
69		Phytoseiidae	*Typhlodromous* sp. n. 1	Y	+	-	-	+	-	Parveen & Gupta, 2019
70			*Typhlodromous* sp. n. 2	Y	+	-	-	+	-	Parveen & Gupta, 2019
71			*Typhlodromous* sp. n. 3	Y	+	-	-	+	-	Parveen & Gupta, 2019
72			*Typhlodromous* sp. n. 4	Y	-	+	-	+	-	Parveen & Gupta, 2020
73			*****Typhlodromous (Anthoseius) egypticus* EL-Badry	Z	+	-	-	+	-	New report
74			*Neoseiulus fallacies* (Garman)	Z	-	+	-	+	-	Parveen & Gupta, 2020
75			*Amblyseius herbicolus* (Chant)	Z	+	-	-	+	-	Mondal & Gupta, 2019
76		Laelapidae	*Cosmolaelaps indicus* Bhattacharyya	X	+	+	-	+	-	Parveen & Gupta, 2019 Parveen & Gupta, 2020
77			*Cyrtolaelaps* sp.	Z	-	+	-	+	-	Parveen & Gupta, 2020
78			*Hypoaspis miles* Berlese	X	+	-	-	+	-	Somchoudhury & Mukherjee, 1987 Das *et al*., 1989 Gupta, 2012
79	Mesostigmata		*Hypoaspis berlesei* (Oudemans)	Z	+	-	-	+	-	Mondal & Gupta, 2019
80			*Hypoaspis aculifer* Canestrini	Y	+	+	-	+	-	Aiswarya *et al*., 2018

81			*Hypoaspis lubrica* Voigts and Oudemans	Z	+	-	-	+	-	New report
82			**Androlaelaps casalis* (Berlese)	Z	+	-	-	+	-	New report
83			*Ololaelaps* sp.	Z	+	-	-	+	-	New report
84		Eviphidae	*Crassicheles* sp.	Z	+	-	-	+	-	Parveen & Gupta, 2019
85		Polyaspididae	*Polyaspis* sp.	Z	+	-	-	+	-	Parveen & Gupta, 2019
86			*Uropolyaspis* sp.	Z	-	+	-	+	-	Parveen & Gupta, 2020
87	Mesostigmata	Resinacaridae	*Resinacarus resinatus* Vitzthum	Z	+	-	-	-	+	Parveen & Gupta, 2019
88		Rhodacaridae	*Rhodacarus* sp.	Z	+	-	-	+	-	Parveen & Gupta, 2019
89		Uropodidae	*Fuscuropoda marginata* C.L.Koch	X	+	+	-	-	+	Aiswarya *et al*., 2018 Parveen & Gupta, 2019 Parveen & Gupta, 2020
90			*Trematura* sp.	Z	+	-	-	-	+	Parveen & Gupta, 2019
91			*Leiodenychus krameri* (Canestrini)	X	-	+	-	-	+	Aiswarya *et al*., 2018 Parveen & Gupta, 2020
92		Veigaidae	*Veiga uncata* Farrier	X	+	-	+	-	-	Parveen & Gupta, 2019
93		Zerconidae	*Zercon prasadi* Blaszak	Z	-	+	-	+	-	Parveen & Gupta, 2020
94		Sejiidae	*Sejus togatus* Koch	Y	+	+	-	+	-	Parveen & Gupta, 2020
95		Macrocheliidae	*Macrocheles muscaedomesticae* (Scopoli)	Y	+	+	-	+	-	Parveen & Gupta, 2020
96			* *Macrocheles glaber* Muller	Z	-	+	-	+	-	New report
97		Neoparasitidae	*Gamasiphis (Neogamasiphis) bengalensis* Bhattacharyya	Z	-	+	-	+	-	Parveen & Gupta, 2020
98		Ameroseiidae	*Kleemania plumosus* (Oudemans)	Z	-	+	-	-	+	Aiswarya *et al*., 2018

99		Zerconopsidae	*Zerconopsis* sp.	Z	-	+	-	-	+	Aiswarya *et al*., 2018
100		Pachylaelapidae	*Pachylaelaps dorsalis* Bhattacharya	Z	+	-	-	+	-	Mondal & Gupta, 2019
101	Sarcoptiformes: Suborder - Oribatida (excluding Astigmata)	Galumnidae	*Galumna flabellifera* Von Heyden	Y	-	+	-	-	+	Parveen & Gupta, 2020
102		Ceratozetidae	*Ceratozetes* sp.	Y	-	+	-	-	+	Parveen & Gupta, 2020
103		Trhypochthoniidae	*Archegozetes* sp.	Z	-	+	-	-	+	Parveen & Gupta, 2020
104		Oppiidae	*Oppia* sp.	Z	-	+	-	-	+	Parveen & Gupta, 2020
105		Oribatulidae	*Oribatula* sp.	Z	-	+	-	-	+	Parveen & Gupta, 2020
106		Austrachipteriidae	*Lemellobates* sp.	Z	-	+	-	-	+	Parveen & Gupta, 2020