

Notes on the family *Graphidaceae* in Darjeeling District of West Bengal, India.

G. Swarnalatha*

Botanical Survey of India, Deccan Regional Centre, Hyderabad-500048, Telangana, India.

*Corresponding Author's Email: swarnalathaginnaram@gmail.com

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ABSTRACT

A total of 36 species of lichen family *Graphidaceae* belonging to eight genera are recorded from Darjeeling district of West Bengal. Of these, 15 species are reported for the first time from the state of West Bengal.

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Introduction:

Darjeeling district of West Bengal is part of Eastern Himalaya (one of the eleven bio-geographical zones in India) and also part of Himalaya Biodiversity Hotspot. The district lies between 87°59' E to 88°53' E longitude and 26°27' N to 27°13' N latitude and covers an area of 3,149 sq km. It shares border with Sikkim to the north, Nepal to the west, West Dinajpur district to south, Bangladesh and the Jalpaiguri district to east. The altitude ranges between 100 m to 3600 m above mean sea level. As part of the revisionary studies of Indian *Graphidaceae*, specimens of the family *Graphidaceae* collected from Darjeeling district of West Bengal deposited in different Indian herbaria (AMH, BSA, CAL, LWG, LWU-LWG) were critically studied. As a result, a total of 36 species of Graphidoid *Graphidaceae* belonging to eight genera were identified. As many as 15 species are reported here for the first time from West Bengal. The species that are new for the state of West Bengal are marked with an asterisk (*).

Materials and Methods:

The present study is based on the specimens from Darjeeling district of West Bengal deposited in the following herbaria: Central National Herbarium, Botanical Survey of India, Howrah (CAL); Botanical Survey of India, Central Regional Centre, Allahabad (BSA); National Botanical Research Institute, Lucknow (LWG); Lichen herbarium of University of Lucknow

deposited at LWG (LWU-LWG) and Ajerekar Mycological Herbarium, Agharkar Research Institute, Pune (AMH). All the specimens cited in this paper were studied at Lichen Laboratory, Botanical Survey of India, Central Regional Centre, Allahabad, during December 2007 to March 2012.

The morphological features of the thalli and ascomycetes were studied under stereo zoom microscopes (Olympus SZ51 and Nikon SMZ1500) and anatomical characters were examined with compound microscopes (Magnus MLX-Tr and Leica DM2500). All anatomical measurements were made in water mounts. Colour spot tests were performed by using K, C and PD reagents. The lichen substances were identified with Thin Layer Chromatography (TLC) using solvent system A, following White & James, 1985. All specimens were examined under UV light (365 nm). The concepts and methodology of Staiger, 2002; Lücking and Rivas Plata, 2008; Lücking, 2009; Lücking *et al.*, 2009 have been followed here.

Enumeration of Taxa:

Diorygma inaequale B.O. Sharma & Makhija, Mycotaxon 107: 90. 2009.

Specimen examined: West Bengal, Darjeeling District, 2 km to Sevak on Guwahati road, north bank of Mahanadi above bridge, 23 Oct. 1977, P.G. Patwardhan & M.B. Nagarkar 77.641 (Holotype AMH!).

Note: This species is known only from the type collection made from a single locality (near Sevak, Darjeeling District).

Diorygma junghuhnii (Mont. & Bosch) Kalb, Staiger & Elix, Symb. Bot. Upsal. 34(1): 157. 2004.

Specimen examined: West Bengal, Darjeeling District, Sukna R. Forest, alt. 1524 m Jan. 1967, C.G. Dharne & K.N. Roychoudhury 544 (CAL).

Diorygma megasporum Kalb, Staiger & Elix, Symb. Bot. Upsal. 34(1): 160. 2004.

Specimens examined: West Bengal, Darjeeling District, Kurseong, alt. 1676 m, 30 Dec. 1966, C.G. Dharne & K.N. Roychoudhury 18 (CAL); Lloyd's Bot. Garden, Dec. 1966, C.G. Dharne & K.N. Roychoudhury 265 (CAL); Senehal lake, 30 Dec. 1966, C.G. Dharne & K.N. Roychoudhury 298 (CAL); Manebhanjan, May 1985, K.N. Roychoudhury 4789 (CAL); Palmajua, June 1985, K.N. Roychoudhury 4943 (CAL).

***Diorygma radiatum** (D.D. Awasthi & S.R. Singh) Kr.P. Singh & Swarnalatha, Indian J. Forest. 32 (1): 179.2009

Specimen examined: West Bengal, Darjeeling District, Rimbik, alt. c. 2077 m, June 1985, K.N. Roychoudhury 4967 (CAL).

Diorygma tuberculosum (Stirt.) Kalb, Staiger & Elix, Symb. Bot. Upsal. 31(1): 177. 2004.

Specimen examined: West Bengal, Darjeeling District, Neora Valley National Park, on the way of PHE camp to Aloorbari camp, alt. c. 2300 m, 11 Mar. 2007, T.A.M. Jagadeesh Ram 4061 (BSA).

Glyphis cicatricosa Ach., Syn. Meth. Lich.: 107. 1814.

Specimen examined: West Bengal, Darjeeling District, Mawsami, alt. 1524 m, 21 Sep. 1967, C.G. Dharne 1026 (CAL).

Graphis acharii Fée, Essai Crypt. Ecorc. : 39, tab. 10, fig. 4. 1824.

Specimens examined: West Bengal, Darjeeling District, Tongloo, June 1966, C.G. Dharne & K.N. Roychoudhury 68 (CAL); Manebhanjan, Mar. 1966, C.G. Dharne & K.N. Roychoudhury 229 (CAL).

Graphis albidofarinacea Adaw. & Makhija, Mycotaxon 96: 53. 2006.

Specimens examined: West Bengal, Darjeeling District, Rangit river valley, on the way to Rangit from Darjeeling, alt. c. 914 m, 08 Mar. 1967, D.D. Awasthi & M.R. Agarwal 67.213 (LWU-LWG); Palmajua, June 1985, K.N. Roychoudhury 4960 (CAL); Kurseong, June 1985, K.N. Roychoudhury 5006 (CAL); Kalimpong, Divisional forest manager office campus, on the bark of *pinus*, alt. c. 1206 m, 6 Mar. 2007, Jagadeesh 3884 (BSA).

***Graphis arecae** Vain., Ann. Acad. Sci. Fenn., ser. A, 15(6): 240. 1921.

Specimen examined: West Bengal, Darjeeling District, Gairidans, on the way of Tonglu, May 1985, K.N. Roychoudhury 4869 (CAL).

***Graphis bipartita** (Müll. Arg.) Lücking, Lücking, Chaves, Sipman, Umaña & Aptroot, Fieldiana, Bot. 46: 61. 2008.

Specimens examined: West Bengal, Darjeeling District, Lloyd's Bot. Garden, alt. 2133 m, Dec. 1966, Dharne & Roychoudhury 269 & 271 (CAL).

Graphis chlorotica A. Massal., Kremp., Verh. K. K. Zool. -Bot. Ges. Wein. 21: 865. 1871.

Specimens examined: West Bengal, Darjeeling District, Kurseong, Dow hill, alt. c. 1981–2042 m, 23 Feb. 1966, D.D. Awasthi & M.R. Agarwal 66.249 (LWU); Batasi, 21 May 1983, K.N. Roychoudhury 4476 (CAL).

Graphis darjeelingensis (Dharne & Roych.) Kr.P. Singh & Swarnalatha

Specimen examined: West Bengal, Darjeeling district, Manebhanjan, Dharne & Roychoudhury 221 (Lectotype CAL!).

Note: So far, *G. darjeelingensis* is known only from the type locality of West Bengal.

***Graphis galactoderma** (Zahlbr.) Lücking, Lücking, Archer & Aptroot, Lichenologist 41 (4): 436 2009.

Specimen examined: West Bengal, Darjeeling District, Palmajua, June 1985, K.N. Roychoudhury 4940 (CAL).

Graphis handelii Zahlbr., Hand. -Mazz., Symb. Sin. 3: 39 & 40. 1930.

Specimen examined: West Bengal, Darjeeling District, Saptagram, Birati, 21 Sep. 1966, K.N. Roychoudhury 392 (CAL).

***Graphis hossei** Vain., Suom. Elain-ja Kasvit. Seuran Van. Julk. 1(3): 54 (1921).

Specimen examined: West Bengal, Darjeeling District, Hermitage, alt. c. 2077 m, 08 May 2010, T.A.M. Jagadeesh Ram 5976 (BSA).

***Graphis immersella** Müll. Arg., Bull. Herb. Boissier 3: 319. 1895

Specimen examined: West Bengal, Darjeeling District, Goobri tea estate, 18 May 1983, K.N. Roychoudhury 4455 (CAL)

Graphis longiramea Müll. Arg., J. Linn. Soc., Bot. 29: 225. 1892.

Specimens examined: West Bengal, Darjeeling District, Manebhanjan, June 1966, alt. 2346 m, C.G. Dharne & K.N. Roychoudhury 80 (CAL); Lloyd's Botanical Garden, Dec. 1966, K.N. Roychoudhury 287 (CAL); Dow hill, Jan. 1967, C.G. Dharne & K.N. Roychoudhury 527 (CAL); Darjeeling-Pashok road,

about 7–8 miles from Darjeeling, alt. c. 1829 m, 06 Mar. 1967, *D.D. Awasthi & M.R. Agarwal* 67.156 (LWU); Selim hills tea estate, alt. 1066 m, 18 May 1983, *K.N. Roychoudhury* 4416 (CAL); Lava forest, Kalimpong, alt. 2438 m, 10 June 1983, *K.N. Roychoudhury* 4657 (CAL); Gouribas, May 1985, *K.N. Roychoudhury* 4763 (CAL); Manebhanjan, May 1985, *K.N. Roychoudhury* 4788 (CAL); Gouribas, May 1985, *K.N. Roychoudhury* 4804 (CAL); Tiger hill, Senchal Wildlife Sanctuary, alt. c. 2413 m, 08 May 2010, *T.A.M. Jagadeesh Ram* 5977 (BSA); Hermitage, alt. c. 2077 m, 09 May 2010, *T.A.M. Jagadeesh Ram* 5999B (BSA).

Graphis neoraensis Jagadeesh & G.P. Sinha, *Mycotaxon* 110: 32. 2009.

Specimens examined: West Bengal, Darjeeling district, Manebhanjan, Dec. 1966, *C.G. Dharne & K.N. Roychoudhury* 219 (CAL); Senchal lake, Dec. 1966, *C.G. Dharne & K.N. Roychoudhury* 300 (CAL); Batasi, 20 May 1983, *K.N. Roychoudhury* 4468 (CAL); Batasi, 25 May 1983, *K.N. Roychoudhury* 4502 (CAL); Manebhanjan, June, 1985, *K.N. Roychoudhury* 4924 (CAL); Neora Valley National Park, Zero Point–PHE Source foot track, alt. 2461 m, 16 May 2008, *T.A.M. Jagadeesh* 4286 (BSA); Neora Valley National Park, Neora riverine forest, Primary rainforest, 2245 m alt., 17 May 2008, *T.A.M. Jagadeesh* 4337 (Holotype BSA!); Neora valley National Park, Chaudapheny–Zero poin way, alt. c. 2341 m, 13 May 2010, *T.A.M. Jagadeesh Ram* 6067 (BSA).

***Graphis nigroglauca** Leight., *Trans. Linn. Soc. London* 27: 174.

Specimen examined: West Bengal, Darjeeling District, Kalimpong, 10 June 1983, *K.N. Roychoudhury* 4726 (CAL).

***Graphis parilis** Kremp., *Flora* 59: 422 & 445. 1876.

Specimen examined: West Bengal, Darjeeling District, Kalimpong division, Munsong, near Inspection Bungalow, alt. c. 1524 m, 09 Mar. 1967, *D.D. Awasthi & M.R. Agarwal* 67.245/F/2 (LWU).

***Graphis pertriosa** (Kremp.) A.W. Archer, *Telopea* 11: 73. 2005.

Specimen examined: West Bengal, Darjeeling District, Kalimpong division, Munsong Cinchona plantation, alt. c. 1524 m, 10 Mar. 1967, *D.D. Awasthi & M.R. Agarwal* 67.294B (LWU).

***Graphis pinicola** Zahlbr., *Hand.-Mazz., Symb. Sin.* 3: 40 & 43. 1930.

Specimen examined: West Bengal, Darjeeling District, *C.G. Dharne & K.N. Roychoudhury* 473 (CAL).

***Graphis proserpens** Vain., *Bot. Tidsskr.* 29(2): 132. 1909.

Specimens examined: West Bengal, Darjeeling District, Kurseong, Dow hills, alt. c. 1981–2042 m, 23 Feb.

1966, *D.D. Awasthi & M.R. Agarwal* 66.249 (LWU–LWG); Majdora, Dec. 1966, *C.G. Dharne & K.N. Roychoudhury* 182 (CAL); Lloyd's Botanical Garden, Dec. 1966, *C.G. Dharne & K.N. Roychoudhury* 282 (CAL); Goomti rest house, 14 May 1983, *K.N. Roychoudhury* 4379 (CAL); Batasi, 22 May 1983, *K.N. Roychoudhury* 4500 (CAL); Batasi, 22 May 1983, *K.N. Roychoudhury* 4512 (CAL); Iongh, alt. c. 2895 m, 25 May 1983, *K.N. Roychoudhury* 4540 (CAL); Iongh, alt. c. 2895 m, 25 May 1983, *K.N. Roychoudhury* 4540 (CAL); Manebhanjan, May 1985, *K.N. Roychoudhury* 4784 (CAL).

Graphis semirigida (Müll. Arg.) Lücking, Lücking, Archer & Aptroot, *lichenologist* 41 (4): 437. 2009.

Specimen examined: West Bengal, Darjeeling District, Neora valley National Park, on the way to Neora river to Dolay river, alt. c. 2150 m, 10 Mar. 2007, *T.A.M. Jagadeesh Ram* 3963 (BSA).

Graphis streblocarpa (Bél.) Nyl., *Flora* 49: 133. 1866.

Specimens examined: West Bengal, Darjeeling District, Palmajua, on the way to Rimbik, June 1985, *K.N. Roychoudhury* 4963 (CAL); Ghumbadora, 08 June 198, *K.N. Roychoudhury* 4964 (CAL).

***Graphis subdisserpens** Nyl., *Bull. Soc. Linn. Normandie*, ser. 2, 7: 175. 1873.

Specimen examined: West Bengal, Darjeeling District, Batasi, 20 May 1983, *K.N. Roychoudhury* 4468 (CAL).

***Graphis tsunodae** Zahlbr., *Ann. Mycol.* 14: 47. 1916.

Specimens examined: West Bengal, Darjeeling District, Lloyd's Botanical Garden, Dec. 1966, *K.N. Roychoudhury* 252 (CAL); Kalimpong division, Munsong, near Inspection Bungalow, alt. c. 1524 m, 09 Mar. 1967, *D.D. Awasthi & M.R. Agarwal* 67.245/F/1 (LWU); Manebhanjan, May 1985, *K.N. Roychoudhury* 4802 (CAL); Hermitage, alt. c. 2077 m, 09 May 2010, *T.A.M. Jagadeesh Ram* 5999B (BSA).

***Graphis urandreae** Vain., *Ann. Acad. Sci. Fenn.*, ser. A, 15(6): 255. 1921

Specimen examined: West Bengal, Darjeeling District, Tiger hills, alt. 564 m, June 1966, *C.G. Dharne & K.N. Roychoudhury* 47 (CAL).

Graphis vittata Müll. Arg., *Flora* 65: 335. 1882

Specimen examined: West Bengal, Darjeeling District, Lloyds Botanical Garden, alt. c. 1976 m, 07 May 2010, *T.A.M. Jagadeesh Ram* 5948 (BSA).

Hemithecium himalayanum Jagadeesh & G.P. Sinha, *Mycotaxon* 110: 31–35, 2009.

Specimens examined: West Bengal, Darjeeling District, Neora Valley National Park, PHE Source–Doley foot track, riverine primary rainforest, alt. c. 2150 m, 10 Mar. 2007, *Jagadeesh Ram* 4008 (BSA); Neora Valley National Park, Mulkharka–Jorepokri foot track, Primary rainforest, alt. 2340 m, 18 May 2008, *T.A.M. Jagadeesh*

Ram 4376 (holotype BSA!); Basti Vergin forest, 22 May 1983, *K.N. Roychoudhury* 4490 (CAL).

Hemithecium nagalandicum (Kr.P. Singh & G.P. Sinha) Adaw. & Makhija, Mycotaxon 92: 390. 2005

Specimens examined: West Bengal, Darjeeling District, Dec. 1966, *C.G. Dharne & K.N. Roychoudhury* 481 (CAL); Labha forest, Jan. 1967, *C.G. Dharne & K.N. Roychoudhury* 488 (CAL).

***Leiorreuma exaltatum** (Mont. & Bosch) Staiger, Biblioth. Lichenol. 85: 298. 2002.

Specimen examined: West Bengal, Darjeeling District, Neora Valley National Park, May 2010, *Jagadeesh Ram* 6055 (BSA).

Pallidogramme bengalense B.O. Sharma & Khadilkar, Lichenologist 43(5): 489. 2011

Specimen examined: West Bengal, Darjeeling District, Manebhanjan, May 1985, *K.N. Roychoudhury* 4782 (CAL).

Phaeographis dendritica (Ach.) Müll. Arg., Flora, 65: 336. 1882b.

Specimen examined: West Bengal, Darjeeling District, Oodlabari, Ghisbeet forest, alt. c. 304 m, 19 Feb. 1966, *D.D. Awasthi & M.R. Agarwal*, s.n. (LWU).

Phaeographis divaricoides Räsänen, in Arch. Soc. Zool. Bot. Fenn. Vanamo 5: 31. 1950.

Specimens examined: West Bengal, Basti Vergin forest, 21 May 1983, *K.N. Roychoudhury* 4459 (CAL); Gouribas, May 1985, *K.N. Roychoudhury* 4904 (CAL); Manebhanjan, June 1985, *K.N. Roychoudhury* 4916 (CAL); Manebhanjan, 01 June 1985, *K.N. Roychoudhury* 4921 (CAL); Basti Vergin forest, alt. 1829 m, 21 May 1983, *K.N. Roychoudhury* 4459 (CAL).

Platygramme caesiopruinosa (Fée) Fée, Bull. Soc. Bot. France 21: 30. 1874.

Specimens examined: West Bengal, Darjeeling District, Darjeeling–Pashok road, about 6–8 miles from Darjeeling, alt. c. 1829 m, 06 Mar. 1967, *D.D. Awasthi & M.R. Agarwal* 67.107 (LWU); Palmajua, June 1985, *K.N. Roychoudhury* 4919 (CAL).

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