

The lichen genus *Heterodermia* (Family Physciaceae) from Maharashtra

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Fourteen species of the lichen genus *Heterodermia* Trevisan are reported from Maharashtra, India. Eight species namely *Heterodermia albicans*, *H. angustiloba*, *H. flabellata*, *H. hypoleuca*, *H. obscurata*, *H. pseudospeciosa*, *H. speciosa* and *H. sp.* are reported for the first time from Maharashtra. *H. albicans* is the new record from India.

Key-words—Lichen, *Heterodermia*, Maharashtra, India.

INTRODUCTION

THE present paper gives an account of the lichen genus *Heterodermia* (Family Physciaceae) from Maharashtra. *Heterodermia* is generally characterized by: foliose thallus, appressed, marginally ascendant, rosettiform or irregularly spreading, linear, elongate ribbon-like and pendulous, heteromerous, corticated on both surfaces or only on upper surface, upper cortex prosoplectenchymatous composed of longitudinally disposed compact hyphae, photobiont a green alga, lower surface often ecorticate, when corticated of periclinal hyphae, with rhizinae or only along margin (when not corticated), apothecia lecanorine, hypothecium lecanorine, hypothecium hyaline to pale, asci 8-spored, spores brown, 2-celled, *Physcia* or *Pachysporaria* type, with or without sporoblastidia, atranorin and zeorin always present.

Only six species of *Heterodermia* were recorded previously from Maharashtra (Patwardhan & Rairkar 1979). Present study describes 14 more species and a key for the identification of species.

MATERIAL AND METHOD

The specimens were examined with a stereomicroscope and light microscope. Sections of the thalli and apothecia were stained with Lugol's Iodine solution. All sections were examined with lactophenol as mounting medium. TLC was done by the standard method (Culberson & Kristinsson

1970; White & James 1985) using solvent systems benzene-dioxane-acetic acid (180:45:5, 230 ml), hexane-ethyl ether-formic acid (130:80:20, 230 ml) and toluene-ethyl acetate-formic acid (139:83:8, 230 ml). The specimens are deposited in the Agharkar Mycological Herbarium (AMH), Agharkar Research Institute, Pune, India.

KEY TO SPECIES

- 1a. Underside corticated 2
- 1b. Underside non-corticate 8
- 2a. Soralia, isidia and squamules absent 3
- 2b. Soralia, isidia and squamules present 4
- 3a. Medulla K-, P-; apothecia laminal, thalline exciple crenulate to squamulose, spores 21-36 x 12-17µm, atranorin and zeorin present *H. diademata*
- 3b. Medulla K+ yellow to red, P+ yellow; spores 28-32 x 11-14µm; atranorin, norstictic, salazinic acids and zeorin present *H. angustiloba*
- 4a. Soralia present, isidia and squamules absent 5
- 4b. Soralia absent, isidia or squamules present 7
- 5a. Soralia ± linear and continuous along margins of lobes, not apical; salazinic acid present *H. albicans*

- 5b. Soralia capitate, on main lobes and on short lateral lobes, in delimited area, \pm labriform; salazinic and norstictic acids may or may not be present 6
- 6a. Soredia farinose; atranorin and zeorin present, norstictic acid and salazinic acid absent *H. speciosa*
- 6b. Soredia subgranular to granular; atranorin, zeorin, norstictic and salazinic acid present *H. pseudospeciosa*
- 7a. Thallus isidiate, upper cortex even, medulla lacking salazinic acid.....*H. isidiophora*
- 7b. Thallus isidiate, upper cortex uneven, medulla containing salazinic acid..... *H. antillarum*
- 8a. Thallus linear, ribbon-like, dichotomously branched, with two equal lobes, lacunae circinate revolute at apices, when young, arising from apex of each mature lobe, elongate and narrow towards apices, spores 34-46 x 16-22 μ m, sporoblastidia present; salazinic acid absent*H. boryi*
- 8b. Branching sympodial, with short lateral lobes, not circinate revolute, on radially extending main lobes9
- 9a. Lobes with yellow ochraceous pigment, sometimes patchy on underside10
- 9b. Lobes lacking yellow ochraceous pigment 11
- 10a.Soralia present *H. obscurata*
- 10b.Soralia absent*H. flabellata*
- 11a.Thallus not compact, lobes softer; main lobes with sort lateral branches; upper cortex forming no or very thin border to under side, norstictic and salazinic acids absent only atranorin and zeorin present12
- 11b.Thallus compact, margin of apothecia crenate to lobulate, salazinic and norstictic acids may be present or absent..... 13
- 12a Soralia absent, upper cortex uneven *H. hypoleuca*
- 12b.Soralia present, upper cortex even *H. sp.*
- 13a. Thallus flabellate; apothecia pedicellate with crenulate to lobulate margin, fibrils not seen at apothecial margin; spores 27-42 x 12-21 μ m, norstictic and slazinic acid present *H. podocarpa*
- 13b. . Thallus flabellate; apothecia becoming tubular, margin of apothecia lobulate, fibrilate; spores 27-45 x 12-20 μ m; norstictic and salazinic acids absent *H. incana*

TAXONOMIC DESCRIPTION

Heterodermia albicans (Pers.) Swinscow & Krog *Lichenologist* 8: 133(1976) = *Parmelia albicans* Pers. *Annln Wetter. Ges.* 2: 17(1811).

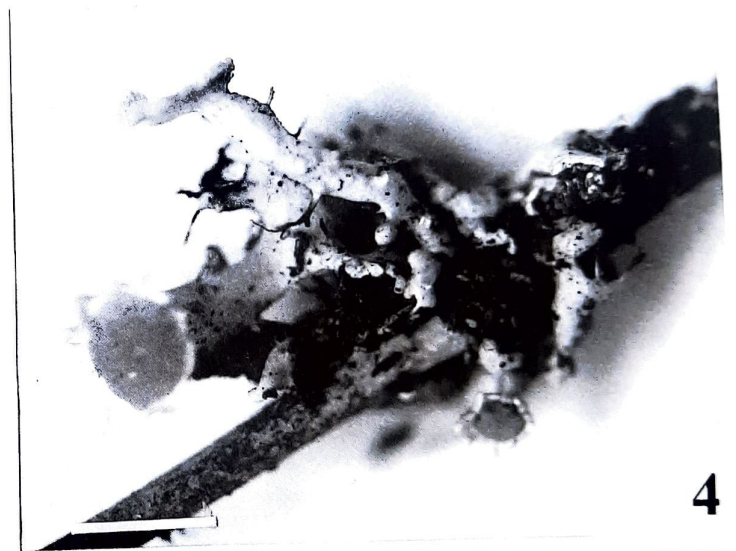
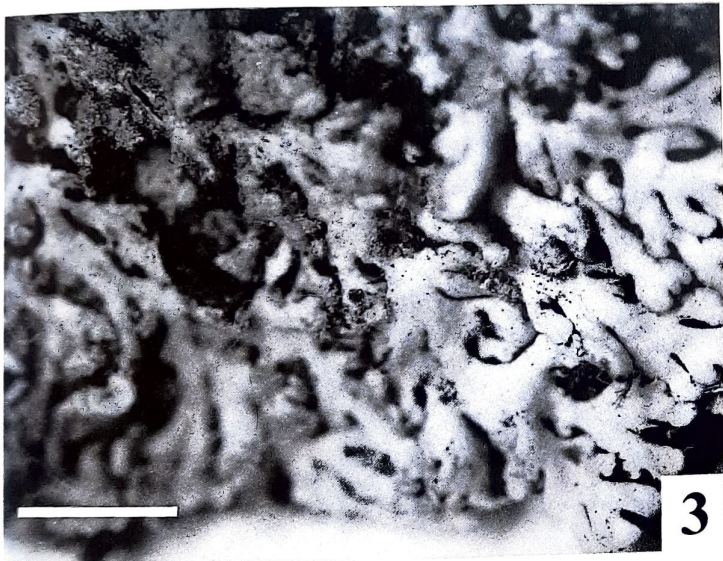
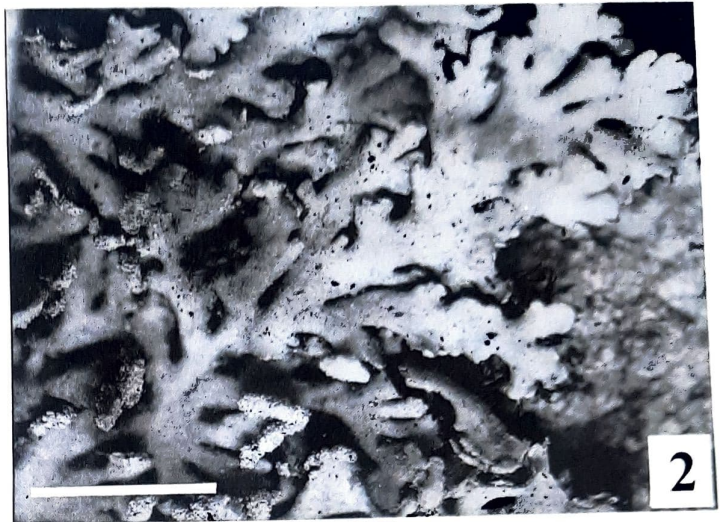
Pl. 1, Fig. 1.

Thallus corticolous, foliose, of radiating, linear-cuneate lobes, yellowish grey, sub-orbicular, loosely adnate to the substratum, 3.5-5 cm across; 210-270 μ m thick; lobes slightly disjunct or adjacent, more or less plane, subdichotomously branched, not ascending, with short lateral lobes, often giving a crenate margin to main lobes, 1-4 mm broad, narrow; upper cortex of somewhat uneven thickness, prosoplectenchymatous, 15-30(35); algal layer 30-51 μ m thick medulla white 120-150 μ m thick; lower surface whitish, lower cortex present, prosoplectenchymatous, 9-35 μ m thick; soralia extended along margins and round apices of lateral lobes, but generally absent from apices of main lobes, producing finely granular soredia.

PLATE 1

1.	<i>Heterodermia albicans</i>	97.55	AMH	5.	<i>Heterodermia diademata</i>	00.45	AMH
2.	<i>Heterodermia angustiloba</i>	03.290	AMH	6.	<i>Heterodermia hypoleuca</i>	80.480	AMH
3.	<i>Heterodermia antillarum</i>	74.1138	AMH	7.	<i>Heterodermia flabellata</i>	00.363	AMH
4.	<i>Heterodermia boryi</i>	01.72	AMH	8.	<i>Heterodermia incana</i>	03.350	AMH

Scale: bar = 5mm



Apothecia not seen.

Chemistry—Thallus K+ yellow; C-, KC-, P+ yellow, medulla K+ yellow, KC-, C-, P+ yellow; atranorin, zeorin, salazinic and substance PQ-4 acids present.

Habitat—Corticolous associated with moss on trees.

Distribution—India (Maharashtra). Canada, Florida, South Africa, tropical and warm temperate America.

Remarks—*Heterodermia albicans*, hitherto not reported from India, is closely related to *H. pseudospeciosa* (Kurok.) W. Culb. but differs in having continuous soralia along the margins rather than localized labriform soralia, and in chemical content. Norstictic acid is present in *H. pseudospeciosa*.

Specimens examined—Maharashtra, Pune District, Bhimashankar, 17.9.1997, B.A. Adawadkar, 97.26; Purandar, 9.7.1973, M.B. Nagarkar, 73.107; 18.6.1977, M.B. Nagarkar, 77.69. Satara District, Mahabaleshwar, 24.9.1997, U.V. Makhija, 97.55, 97.60.

Heterodermia angustiloba (Müll. Arg.) Awasthi *Geophytology* 3: 113 (1973) = *Anaptychia speciosa* var. *angustiloba* Müll. Arg. *Flora* 66: 78 (1883).

Pl. 1, Fig. 2

Thallus corticolous, foliose, dark grey, orbicular, closely adnate to the substratum, 2-3.5 cm in diam. 135-231µm thick; lobes disjunct or adjacent, plane, distinctly furcate to subdichotomously branched, 0.4-1 mm broad, narrow, incised; soredia and isidia absent; upper cortex prosoplectenchymatous, uneven, 35-53µm; algal cells in groups, 21-25.2µm; medulla white, 48-64µm thick; lower surface whitish; lower cortex prosoplectenchymatous, 28-35µm thick; rhizines black.

Apothecia laminal, sessile to substipitate, rounded, 0.8-1.8 mm in diam; disc plane to concave, brown to black, epruinose; thalline margin entire, crenulate; epithecium brown 12-16µm tall; hymenium hyaline, 73.5-91µm high; hypothecium hyaline, 17.5-28µm high; paraphyses simple, septate; asci cylindrical or subclavate, unitunicate, 60-100 x 12-16µm in size, I+ blue. Ascospores 8/ascus, brown, 1-septate, ovate, 28-31.5 x 11-14µm in size, with sporoblastidia.

Chemistry—Cortex K + yellow, C-, KC-, P+ deep yellow, medulla K+ yellow; atranorin, zeorin, norstictic and salazinic acids present.

Habitat—On trees in open and moist places at higher elevation.

Distribution—India (Himalayas and Maharashtra). Australia, Nepal.

Remarks—*Heterodermia angustiloba* is most closely related to the species *H. diademata* (Taylor) Awasthi. However, *H. diademata* differs especially in lacking norstictic and salazinic acid in its thallus. The species was previously reported from Himalaya and is now reported from Maharashtra.

Specimens examined—Maharashtra, Kolhapur District, Panhala, 13.10.2000, U.V. Makhija & V.A. Mantri, 00.397, On the way to Amboli from Ajra, 10.10.2000, U.V. Makhija & B.C. Behra, 00.191. Pune District, Durgwadi, 2.9.2003, U.V. Makhija & B.C. Behera, 03.287, 03.290; Sinhadgad, 4.7.2003, U.V. Makhija & G.S. Chitale, 03.22, 03.48. Satara District, Panchgani, Tata Holiday Home 29.9.2003, G.S. Chitale & A.V. Dube, 03.364, 03.412.

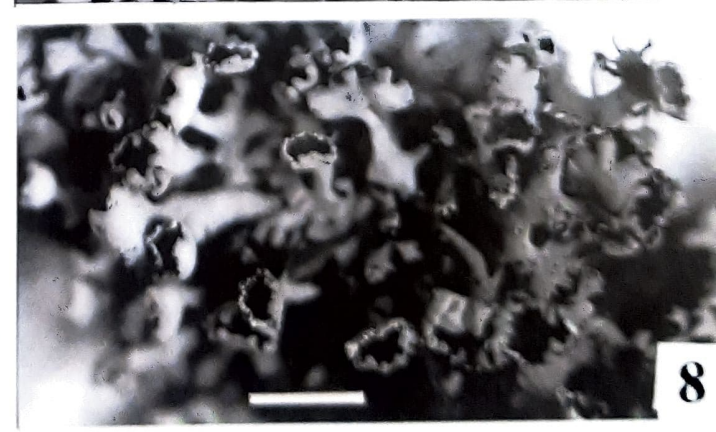
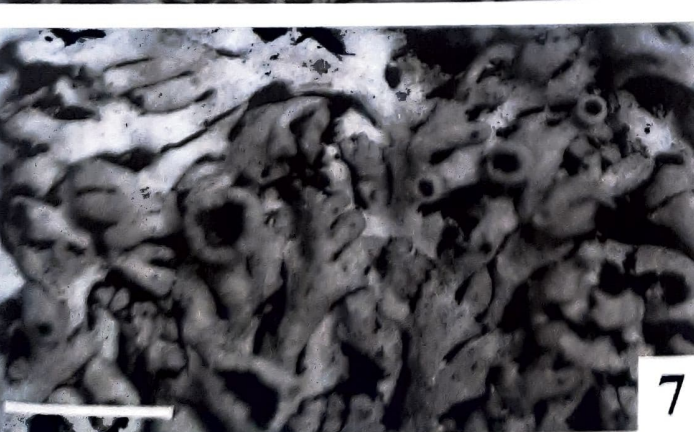
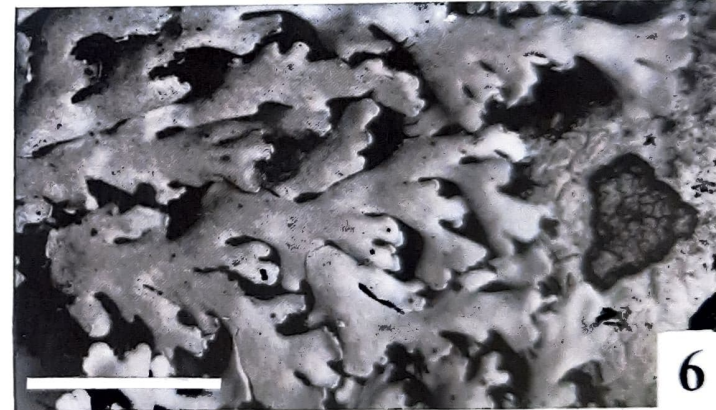
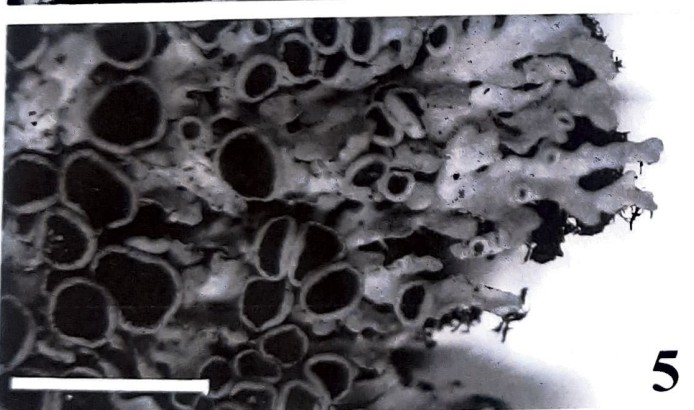
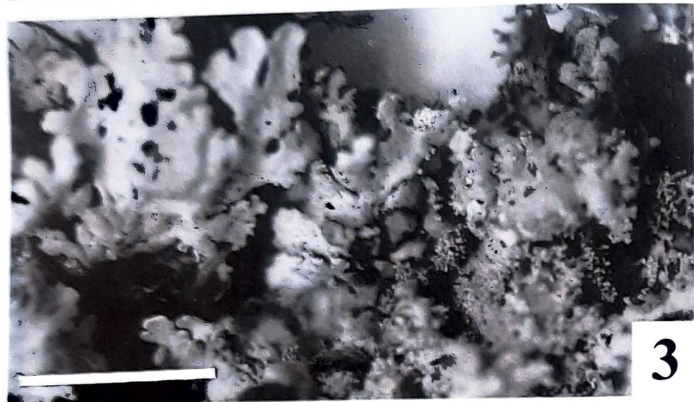
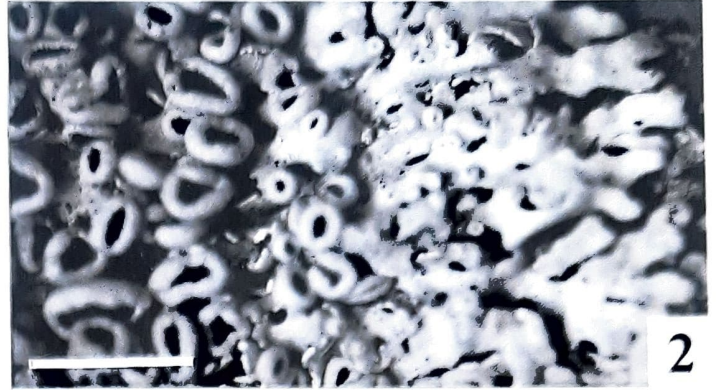
Heterodermia antillarum (Vainio) Swinscow & Krog *Lichenologist* 8: 114(1976) = *Anaptychia granulifera* var. *antillarum* Vainio *Suomal. Tiedeakat. Toim.*, Ser. A, 6: 63 (1914).

Pl. 1 Fig. 3

PLATE 2. →

1.	<i>Heterodermia isidiophora</i>	00.250	AMH	4.	<i>Heterodermia podocarpa</i>	04.59	AMH
2.	<i>Heterodermia cf. japonica</i>	81.278	AMH	5.	<i>Heterodermia pseudospeciosa</i>	03.351	AMH
3.	<i>Heterodermia obscurata</i>	90.16b	*AMH	6.	<i>Heterodermia speciosa</i>	03.180	AMH

Scale: bar = 5 mm



Thallus corticolous, foliose, greenish-grey, 3-5 cm in diam, 119-228.5µm thick; lobes slightly disjunct or adjacent, plane closely adpressed to the substratum, discrete only at periphery, irregularly branched, with short lateral lobes, 0.5-0.8 mm broad, with numerous laminal and marginal isidia; isidia concolorous, cylindrical to flattened, simple or branched, lobes converted into isidia; upper cortex prosoplectenchymatous, uneven, 21-52µm thick; algal layer 24.5-50µm thick; medulla hyaline, 56-91µm thick; lower surface whitish-green, with a prosoplectenchymatous cortex of 18-35µm thickness; sparsely rhizinate, white when young, turning black.

Apothecia absent.

Chemistry—Cortex and medulla K+ yellow, C, KC, P+ yellow; atranorin, salazinic, zeorin and an unknown substance (indicated by a pink spot just above the salazinic acid on the TLC plate) is present.

Habitat—Collected on trees in open places along the road side.

Distribution—India (Karnataka and Maharashtra). E. Southern Africa, Australia, Mexico, West Indies.

Remarks—The present species is being reported for the first time from India and is closely related to *Heterodermia diademata* (Taylor) Awasthi in morphology of the thallus but differs significantly in having isidia. *H. antillarum* differs from another isidiate species *Heterodermia isidiophora* (Vainio) Awasthi, in having more flattened isidia. The specimens at hand have distinct pruina on some lobes.

Specimens examined—Maharashtra, Kolhapur District, Panhala, 13.10.1974, P.G. Patwardhan & A.V. Prabhu, 74.1025, 74.1138; Sindhudurg District, on the way to Amboli from Ajra, 10.10.2000, U.V. Makhija & B.A. Adawadkar, 00.157, 00.203.

Heterodermia boryi (Fée) K.P. Singh & S.R. Singh *Geophytology* 6 : 33 (1976). = *Borreria boryi* Fée, *Essai Crypt. Ecorc. Officin. Introd.* 96 et. tab. II fig. 23 (1824).

Pl. 1 Fig. 4

Thallus greyish white, to brownish-grey, 5 to 12 cm in diam., 125-213µm thick; lobes long, narrow, 1.0-1.2 mm broad, ascending, dichotomously branched, becoming narrower towards apices, circinate-revolute; upper surface smooth, irregularly corticate, 25-40µm thick; algal layer, 40-60µm thick; medulla white, 41-70µm thick; lower surface white, pulverulent, sometimes sorediate, ecorticate; rhizines marginal, simple, rarely branched, black, 2-4 mm long.

Apothecia laminal to apical, subterminal, sessile to substipitate, 1-3 mm in diam., with entire to crenulate margin often with black cilia; epithecium brown, 18-25µm thick; hymenium hyaline, 135-150µm high; hypothecium 35-45µm high; asci cylindrical to clavate, unitunicate, shortly stalked, I + blue, 115-130 x 20-27 µm in size. Ascospores brown, ellipsoidal, 1-septate, constricted at the septum, with many sporoblastidia, 33-46 x 16-22 µm in size.

Chemistry—Thallus K + yellow, medulla K + yellow, C-, KC-, P-; atranorin and zeorin present.

Habitat—Commonly found over mosses, on basal portion of trees in moist places often associated with *Leptogium*.

Distribution—India (Himalayas, Kerala, Maharashtra, Nagaland, Tamil Nadu). America, Australia, Canada. Widely distributed in tropical and temperate regions of the world.

Remarks—This species differs from *Heterodermia leucomelos* (L.) Poelt ssp. *Leucomelos* (Fée) Swinscow & Krog in having narrower lobes and lacking salazinic acid. In Maharashtra the species is rather uncommon.

Specimens examined—Maharashtra, Pune District, Bhimashankar, 13.11.1971, P.G. Patwardhan 71.72, 71.73. Sastra District, Mahabaleshwar, Dhobi waterfall, M.B. Nagarkar, 74.82, 74.83; Kas Lake, 11.4.1979, V.D. Vartak, 79.215; 5.10.2001, B.C. Behera & U.V. Makhija, 01.71, 01.72, 01.74.

Heterodermia diademata (Taylor) Awasthi
Geophytology 3: 113 (1973) = *Parmelia diademata*
Taylor *J. Bot. Lond.*, 6: 165 (1847).

Pl. 1, Fig. 5

Thallus foliose, greyish white to yellowish grey, loosely adnate to the substratum 2-12 cm in diam. 232-323µm thick; lobes disjunct or adjacent, plane, distinctly furcate to subdichotomously branched, with short lateral lobes, 0.5-1.5 mm broad, without isidia and soredia; upper cortex, prosoplectenchymatous, evenly thickened, 42-50µm; algal layer 26-29µm thick; medulla white, 134-197µm thick; lower surface silver white; lower cortex prosoplectenchymatous, 21-29.4µm thick; rhizines sparse, laminal or marginal, white to dark brown, dichotomously or irregularly branched.

Apothecia laminal, sessile to subsessile, rounded, 0.6-6 mm in diam.; disc concave, dark brown to black; thalline margin entire, crenulate or lobulate, thick; epithecium brown, 16.8-21µm thick; hymenium hyaline, 67-101µm high; hypothecium hyaline, 25-38µm high; paraphyses simple, septate; asci cylindrical or subclavate, unitunicate, I + blue, 72-105 x 12-16.8µm in size. Ascospores brown, 1-septate, ovate, 21-33 x 12-17 µm in size, without sporoblastidia.

Chemistry—Thallus K+yellow, medulla K+ yellow, C-, KC-, P+ deep yellow; atranorin, chloroatranorin and zeorin present.

Habitat—Commonly found in Maharashtra on the trunks and the branches of the trees. Also found on sheltered rocks, at altitudes 1000-1500m, often associated with other members of Physciaceae.

Distribution—India (Himalaya, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Nagaland, Sikkim, Uttar Pradesh, Tamil Nadu and West Bengal). America, Australia, Canada. Widely distributed in tropical and temperate regions of the world.

Remarks—*Heterodermia diademata* is one of the most common species of this genus found in Maharashtra and in general in India. The specimens collected in Panhala, showed presence of chloroatranorin, atranorin and zeorin. This species is

closely related to *H. angustiloba* as it lacks both soredia and isidia, however, they differ in chemistry. *H. angustiloba* has norstictic and salazinic in addition to atranorin and zeorin.

Specimens examined—Maharashtra, Ahmednagar District, Bhandardara, 25.9.2002, A.V. Bhosale & G.S. Chitale, 02.142. Kolhapur District, Panhala, 13.10.1974, P.G. Patwardhan & C.R. Kulkarni, 74.1156, 74.1159, 74.1160, 74.1199, 74.1204, 74.1214; 13.10.2000, U.V. Makhija. 00.400b, 00.410a, 00.465. Pune District, Bhimashankar, 6.9.1970, P.G. Patwardhan & P.D. Badhe, 70.37; Dongarwadi, 19.9.2000, U.V. Makhija & B.C. Behera, 00.122; Khandala, 14.7.1970, P.G. Patwardhan & P.D. Badhe, 70.18; 19.11.1972, P.D. Badhe, 72.45, 72.191; Lonawala, 29.8.2000, B.A. Adawadkar & V.A. Mantri 00.98, Walwan dam, 16.9.2002, B.A. Adawadkar & A.V. Bhosale, 02.109; Malshej ghat, Neemgiri, 9.9.2002, U.V. Makhija & G.S. Chitale, 02.1, 02.3, 02.10; Karnala, 16.9.2002, U.V. Makhija & B.C. Behera, 02.100; Purandhar, 12.3.1971, P.G. Patwardhan & P.D. Badhe, 71.12; 13.9.2002, B.C. Behera & G.S. Chitale, 02.69, 02.71, 02.72, 02.76, P.G. Patwardhan, 71.34, 71.36; P.G. Patwardhan, Date ? 72.131, 72.134, 72.137; 9.7.1973, M.B. Nagarkar, 73.109, 73.110, 73.212, 74.312; 11.11.1976, P.G. Patwardhan & U.V. Makhija, 76.1271, Sinhgad, 19.7.1970, P.D. Badhe, 70.22; 19.5.1974, C.R. Kulkarni, 74.101, No. 51, 00.34, 00.37, 00.45, 00.46. Nasik District, Anjaneri, 26.9.2002, B.C. Behera & B.A. Adawadkar, 02.223, Saptashringi, 3.8.1974, M.B. Nagarkar & A.V. Prabhu, 74.215; 24.9.2002, B.C. Behera & A.V. Bhosale, 02.174, 02.177, 02.195. Satara District, Kas dam, 11.4.1979, V.D. Vartak, 79.220; Mahabaleshwar, Lodwick, Wilson point, 7.6.1970, P.D. Badhe, 70.11, 70.18A; Arthur seat, 27.11.1974, M.B. Nagarkar & A.V. Prabhu, 74.1755; Panchgani, 4.8.1981, P.G. Patwardhan, 81.303; 25.9.2001, G.S. Chitale, 01.62. Sindhudurg District, Amboli, 18.10.1974, C.R. Kulkarni & A.V. Prabhu, 74.1557; Ajra to Amboli Road, 7.12.1974, C.R. Kulkarni & A.V. Prabhu, 74.2240, 74.2242, 74.2244; 8.12.1974, P.G.

Patwardhan & M.B. Nagarkar, 74.2270; Amboli to Ajra Road 00.159.

Heterodermia flabellata (Fée) Awasthi *Geophytology* 3: 113 (1973) = *Parmelia flabellata* Fée *Suppl. Essai. Crypt. Ecorc. Exot. Offici.* 122 (1837).

Pl. 1, Fig. 7

Thallus greenish, grey white or yellowish white, 8-12 cm in diam., 147-273 µm thick; lobes disjunct or adjacent, more or less plane, minutely notched, with short lateral lobes, without isidia or soredia, 0.5-1.2 mm broad; upper surface plane; upper cortex prosoplectenchymatous, 63-105 µm thick; algal layer 42-100 µm thick; medulla hyaline, 84.5-106 µm thick; lower surface ecorticate, with yellowish orange pigment, K+ purple-red; rhizines, mostly marginal, or a few laminal, short, simple or squarrose, black.

Apothecia laminal, adnate to stipitate, 2-7 mm in diameter; disc blackish brown, flat, slightly pruinose, concave; margin crenulate to distinctly lobulate; epithecium brown, 8-17 µm thick; hymenium hyaline, 84-100 µm high; hypothecium hyaline to pale, 63-84 µm high; paraphyses branched, brown and thick at apices; asci cylindrico-clavate, 52.5-91 x 7-14 µm in size. Ascospores 1-septate, with 2-3 sporoblastidia at each end, 29-33 x 16-21 µm in size.

Chemistry—Thallus K+ yellow, medulla K+ yellow, C-, KC-, P+ light yellow; pigment on lower surface K+ purple red, cortex of receptacle I-; atranorin, zeorin and a yellow pigment present.

Habitat—Occurs on trees and the twigs of shrubs and on rocks.

Distribution—India (Karnataka, Maharashtra, Manipur, Nagaland, Tamil Nadu and Uttar Pradesh). Tropical and subtropical regions of Africa, Asia, Central America, South America and West Indies.

Remarks—*Heterodermia flabellata* (Fée) Awasthi closely resembles *H. obscurata* (Nyl.) Trevis. externally and also in producing same unknown yellow pigment, but differs from the latter species in not having soredia. It is a very common species in western ghats. *Specimens examined*—Maharashtra, Kolhapur

District, Panhala, 13.10.1974, P.G. Patwardhan & C.R. Kulkarni, 74.1194; Vishalgarh, 6.12.1974, M.B. Nagarkar, 74.2177. Pune District, Malavali-Bhaja road, 26.7.1974, M.B. Nagarkar & A.V. Prabhu, 74.119, 74.120, 74.121; Khandala, Boma hills, 19.9.1974, M.B. Nagarkar & A.V. Prabhu, 74.682, 74.684, 74.685. Ratnagiri District, Dabhole ghat, 5.12.1974, A.V. Prabhu & M.B. Nagarkar, 74.210, 74.216, 74.2106, 74.2107; Hathkhamba, on Chiplun to Ratnagiri road, 5.12.1974, M.B. Nagarkar & P.G. Patwardhan, 74.1984, 74.1985, 74.2029, 74.2030. Sindhudurg District, On the way to Ajra from Amboli, 10.10.2000, U.V. Makhija & K.R. Randive, 00.159, 00.164; On the way to Vaibhavwadi, 12.10.2000, B.A. Adawadkar & K.R. Randive, 00.363, 00.364.

Heterodermia hypoleuca (Ach.) Trevis. *Atti Soc. Ital. Nat.* 11: 615 (1868-1869) = *Parmelia speciosa* b. *hypoleuca* Ach., *Syn. Lich.* p. 211 (1814).

Pl. 1, Fig. 6

Thallus greyish white to yellowish, 8-12 cm in diam., 117-252 µm thick; lobes disjunct or adjacent, more or less plane, not ascending, with short lateral lobes, without isidia or soredia, 0.5-1.5 mm broad; upper surface plane, white; upper cortex uneven prosoplectenchymatous, 27-75 µm thick; algal layer, 30-66 µm medulla hyaline, 60-111 µm thick; lower surface ecorticate, white to yellowish white, K+ red but in patches; rhizines, few marginal, and laminal, short, simple at margin, and laminal are branched, black.

Apothecia not seen.

Chemistry—Thallus K+ yellow, C-, KC-, P+ yellow, medulla K-, C-, KC-, P-; atranorin zeorin and 3 terpenes.

Habitat—Collected on tree on road side in the region receiving heavy rainfall during monsoon.

Distribution—India (Maharashtra). America, Asia, Australia, Canada, Wide spread in East Africa.

Remarks—Species is not known by only single specimen.

Specimens examined—Maharashtra, Sindhudurg District, Amboli, 22.9.1980, P.G. Patwardhan, 80.480.

Heterodermia incana (Stirton) Zahlbr. *Geophytology* 3: 113 (1973) = *Physcia incana* Stirton. *Proc. Phil. Soc. Glasgow* 11: 322 (1897).

Pl. 1, Fig. 8

Thallus glaucous white to brownish-white, attached to the substrate only in the central part, 150-210 μm thick; lobes 1-3.5-(5) mm broad, initially narrow and then broader and convex, expanded, loosely adpressed and ascending; soredia and isidia absent; upper surface unevenly corticated; cortex 65-85 μm thick, often projecting downward to the medulla white, 65-85 μm , I + violet; lower surface white farinose, ecorticate; rhizines simple, marginal, basally concolorous with the thallus, turning dark brown to black.

Apothecia stipitate, arising subapically becoming tubular, 1.5-6(9) mm in diam; disc dark brown, white pruinose; margin crenate to lobulate, sometimes fibrillate; epithecium brown, 10-15 μm thick; hymenium hyaline, 100-150 μm high; hypothecium 35-50 μm high, asci unitunicate, subclavate, I + blue, 125-150 x 20-30 μm in size. Ascospores 1-septate, oval, ellipsoidal, with 2-3 sporoblastidia at each end, 27-45 x 12-20 μm in size.

Chemistry—Thallus K+ yellow, medulla K + yellow, C-, KC-, P + deep yellow; atranorin and zeorin present.

Habitat—The present species is found associated with *Usnea ghattensis*.

Distribution—India (Kerala, Maharashtra, Nagaland, Sikkim, Tamil Nadu, and West Bengal) Java, Nepal, Sri Lanka, Taiwan, and Thailand.

Remarks—*Heterodermia incana*, closely resembles to *H. awasthii* (Kurok.) Awasthi and can be distinguished from the latter by the absence of norstictic and salazinic acid in this species. It also closely resembles to *H. podocarpa* in having similar morphology but has margin of apothecia fibrillate.

Specimens examined—Maharashtra, Satara District, Mahabaleshwar, Lingmala, 15.7.2003, B.C. Behera & N. Verma, 03.146, 03.150, 03.155; 29.9.2003, G.S. Chitale & A.V. Dube, 03.348, 03.349, 03.350;

Wilson Point, 23.11.1985, P.G. Patwardhan, 85.2939; Panchgani, Tata Holiday Home, 29.9.2003, A.V. Dube & N. Verma, 03.484. Sindhudurg District, On the way to Phonda from Radhanagari, 12.10.2000, U.V. Makhija & V.A. Mantri, 00.320. Pune District, Amby Valley near Lonwala, 5.8.2003, B.A. Adawadkar & N. Verma, 03.245; Bhimashankar, 30.9.1974, A.V. Prabhu, 74.795, 74.866.

Heterodermia isidiophora (Vainio) Awasthi *Geophytology* 3: 114 (1973) = *Anaptychia isidiophora* Vainio *Cat. Afr. Pl. Coll. Welwitsch* 2: 409 (1901).

Pl. 2, Fig. 1

Thallus yellowish white to greyish white, 5-10 cm in diam., 200-300 μm thick; lobes loosely adpressed to the substratum, contiguous in central part, discrete only at periphery, dichotomously or irregularly branched, with short lateral lobes, 0.5-1.5 mm broad, with numerous laminal and marginal isidia; isidia cylindrical and coralloid; upper surface plane, with a cortex of even thickness, 42-75 μm ; medulla white, 60-110 μm thick; lower surface corticate, brown, sparsely rhizinate, 20-25 μm thick.

Apothecia rare, laminal, sessile to substipitate, with isidiate margin; disc black, 1.0-2.8 mm in diam.; asci unitunicate, cylindrical. Ascospores 1-septate, without sporoblastidia, 26-37 x 12-16 μm .

Chemistry—Thallus K+ yellow, medulla K + yellow, C-, KC-, P + yellow; atranorin and zeorin present.

Habitat—Collected on trees in open places along the road side.

Distribution—India (Kerala, Maharashtra, Nagaland, Tamil Nadu, and West Bengal). Central and South America, Africa, Asia, Australia, Great Britain, New Zealand, world wide in tropical and temperate regions of the world.

Remarks—*Heterodermia isidiophora* is closely related to *H. diademata* (Taylor) Awasthi in morphology of thallus and size of ascospores, but differs significantly in having isidia. It also resembles *H. antillarum* (Vainio) Swinscow & Krog, however, it can be separated from the latter

species especially in its chemistry. *H. antillarum* produces norstictic and salazinic acid and has only marginal isidia.

Specimens examined—Maharashtra, Kolhapur District, on the way to Kasal from Sawantwadi, 11.10.2000, U.V. Makhija & B.A. Adawadkar, 00.250 – AMH.

Heterodermia sp. *Lichenologist* 8: 122 (1976) = *Anaptychia dentritica* (Pers.) Vain. var. *japonica* Sato, *J. Jap. Bot.* 12: 427 (1936).

Pl. 2 Fig. 2

Thallus corticolous, foliose, pale white, 2.5-4 cm in diam.; lobes closely adpressed, disjunct to adjacent, irregularly branched, with short lateral lobes, plane, imbricate, profusely branched, narrow, 0.5-1.5(2) mm broad, 178-240µm thick, with numerous marginal soredia; upper cortex prosoplectenchymatous, unevenly thickened 26-85 µm; medulla 126-162 µm thick; lower surface, pale-white, ecorticate, rhizinate, K; rhizines profusely branched.

Apothecia absent.

Chemistry—Thallus K + yellow to red and P + yellow; medulla K-, C-, KC-, P-; atranorin and zeorin is present.

Habitat—Collected on trees in open places along the road side at elevation.

Distribution—India (Maharashtra). America, Australia, Canada, Canary Islands, South Africa, Asia, Florida, New Zealand.

Remarks—The present species seems to be a new species most closely related to *Heterodermia japonica* on account of the morphology of the thallus, but differs in having unevenly thickened upper cortex, and by its lower surface pale white K-. *H. japonica*, has a thallus with white to blackish-violet under surface. Since the apothecia have not been observed in the specimens at hand for the time being it has been kept as a closely related form of *H. japonica*.

Specimens examined—Maharashtra, Kolhapur District, Panhala, 90.33 AMH. Satara District,

Mahabaleshwar, 25.9.2001, A.V. Bhosale, 01.22; Panchgani, 4.8.1981, P.G. Patwardhan, 81.278.

Heterodermia obscurata (Nyl.) Trevisan *Nuovo Giorn. Bot. Ital.* 1: 114 (1869) = *Physcia obscurata* Nyl. *Annls Sci. Nat., Bot.*, ser 4, 19: 310 (1863).

Pl. 2 Fig. 3

Thallus greyish white to brownish grey, 5 to 10 cm in diam. 210-252 µm thick; lobes dichotomously to irregularly branched, not ascending, with short lateral lobes, 0.5-1 mm broad; upper surface plane to convex, smooth, epruinose, sorediate; soralia labriform on recurved apices of lobes; upper cortex irregular, prosoplectenchymatous 63-84 µm thick; algal layer discontinuous, 21-42 µm thick; with ochraceous orange hyphae overlying medulla, K+ purple towards periphery, 105-121.8 µm; lower surface white, ecorticate.

Apothecia not seen.

Chemistry—Thallus K+ yellow, medulla K+ yellow, C-, KC-, P + yellow; atranorin and zeorin present.

Habitat—It grows on sheltered mossy trees and rocks, usually in partial shade.

Distribution—India (Himachal Pradesh, Manipur, Maharashtra and Uttar Pradesh). Africa, Asia, North and South America, Australia, Britain, Canada, Europe, Ireland, New Zealand, West Scotland. Widely distributed in tropical and temperate regions of the world.

Remarks—*Heterodermia obscurata* can be distinguished by its labriform soredia on recurved lobe apices and ecorticate, ochraceous K+ purple lower surface. In external morphology it resembles *H. hypocaustia* (Yesuda) Awasthi which has salazinic acid. It is also similar to *H. flabellate* (Feé) Mass. as regard the ochraceous pigment overlying medulla but, it can be separated by the presence of capitate soralia in the present species.

This species has been reported for the first time from Maharashtra.

Specimens examined—Maharashtra, Kolhapur District, Amba, 17.10.1974, A.V. Prabhu & C.R. Kulkarni, 74.1383; Panhala, 4.9.1990, U.V. Makhija & B.A. Adawadkar, 90.16b, 90.34.

Heterodermia podocarpa (Bél.) Awasthi *Geophytology* 3: 114 (1973) = *Parmelia podocarpa* Bél. *Voy. Ind. Orient. Bot.*, 2: *Crypt.*: 122. Pl. e, Fig. 1 (1840).

Pl. 2, Fig. 4

Thallus foliose, loosely adnate to the substratum, 3-5 cm in diam., repeatedly dichotomously branched; lobes disjunct to imbricate, convex, ascending, with short or lateral lobes, non-isidiate, non-soresiate, 2-5 mm broad, 213-365 μm thick; upper surface of the thallus green, unevenly corticate; lower surface silvery-white, non corticate, rhizines absent, but fibrils present, upto 4 mm long, dichotomously or irregularly branched grey or pale yellow.

Apothecia apical or subapical, pedicellate, rounded, 1.3 to c. 5 mm in diam.; disc dark brown to black, pruinose, concave; margin thick, crenate to lobulate; asci simple, unitunicate, octosporous, 96-160 x 24-56 μm in size. Ascospores brown, two celled, ellipsoid, mostly biseriate, with 2-3 sporoblastidia at each end, 27-42 x 12-21 μm in size.

Chemistry—Thallus K+ yellow, medulla K+ yellow, C-, KC-, P+ yellow; atranorin, norstictic, salazinic and zeorin present.

Habitat—Grows on bark, mainly on twigs and has been collected in the surroundings of the waterfall.

Distribution—India (Eastern and North Western Himalayas, Maharashtra, and South India). Australia, New Zealand. World wide in tropics.

Remarks—*Heterodermia podocarpa* is uncommon in Maharashtra. In field it can be easily distinguished by its suberect thallus with flabellate lobes, stipitate apothecia with crenate-lacinulate margin.

Specimens examined—Pune District, Bhimashankar, 13.9.1974, M.B. Nagarkar & C.R. Kulkarni, 74.867, 74.881, 74.882; 17.9.1997, B.A. Adawadkar, 97.9; Durgawadi, 2.9.2003, U.V.

Makhija & A.V. Dube, 03.292. Khandala, Boma hills, 18.9.1974, C.R. Kulkarni & M.B. Nagarkar, 74. 714, Satara District, Mahabaleshwar, 7.6.1970, P.D. Badhe, 70.9, Herbarium No. 16; 8.6.1971, P.G. Patwardhan & P.D. Badhe, 71.21, Wilson Pt. 1.11.1973, P.G. Patwardhan & C.R. Kulkarni, 73.2933, Gureghar, 8.8.1991, P.G. Patwardhan & U.V. Makhija, 91.5, 21.1.2004, B.C. Behera & G.S. Chitale, 04.58; Lingmala 15.12.1973, V.D. Vartak, 73.3134; 14.12.1973, 73.1752, Lodwick Point, 28.11.1974, M.B. Nagarkar & A.V. Prabhu, 74.1845, 21.1.2004, B.C. Behera & G.S. Chitale, 04.59; Satara, Kas Lake, 11.4.1979, V.D. Vartak, 79.218; 5.10.2001, B.A. Adawadkar & G.S. Chitale, 01.73, 01.77. Panchgani, U.V. Makhija & D.W. Rane, 80.316.

Heterodermia pseudospeciosa (Kurok.) W. Culb. *Bryologist* 69: 484 (1966) = *Anaptychia pseudospeciosa* Kurok, *J. Jap. Bot.* 34: 176 (1959).

Pl. 2, Fig. 5

Thallus corticolous, foliose, yellowish-grey to grey, rough with small granules, loosely adnate to the substratum, 3-8 cm in diam., 63-84 μm thick, repeatedly dichotomously branched; lobes disjunct to imbricate, convex, ascending, flexuous, with short lateral lobes, 1.5-2 mm broad, repeatedly dichotomously branched, flexuous; soralia apical on main and lateral lobes; upper cortex with a greyish surface layer, prosoplectenchymatous, 16.8-25 μm thick; algal layer discontinued by downward projecting cortex, 25-38 μm thick; medulla white 147-168 μm ; lower surface corticate, white or brownish, lower cortex 16.8-29 μm thick: sparsely rhizinate, rhizines irregularly branched, black, light at the base.

Apothecia rare, superficial, subsessile, 1-4 mm in diam., margin entire to crenate becoming soresiate; disc brown, epruinose, plane; epithecium brown, 21-29 μm thick; hymenium hyaline, I + blue, 97-110 μm high; hypothecium pale yellow, 21-25 μm high, followed by a discontinuous layer of spherical algae 42-63 μm thick; asci subclavate, I + blue at tip, unitunicate, shortly pedicellate, 88-118 x 25-34 μm in size. Ascospores slightly constricted in

the middle, with two subglobose locules, without sporoblastidia; 22-29 x 11-13 µm in size.

Chemistry—Thallus K+ yellow, C-, KC-, P+ yellow; medulla K+, C-, KC-, P+ yellow; atranorin, norstictic, salazinic and zeorin present.

Habitat—Abundant on bark of tree in open places along the road sides.

Distribution—India (Himalaya, Maharashtra, Manipur, Nagaland, Uttar Pradesh, and West Bengal). East Africa, Japan, North and South America, Australia, Canada, Taiwan. Worldwide in tropics.

Remarks—*Heterodermia pseudospeciosa* is being reported for the first time from Maharashtra. It is characterised by the presence of capitate soredia, and the presence of norstictic and salazinic acids, otherwise it is very much similar to *H. diademata* (Taylor) Awasthi.

Specimens examined—Maharashtra, Kolhapur District, 13.10.2000, U.V. Makhija & K.R. Randive, Panhala 00.399, 00.404; Near Guest house; U.V. Makhija & V.A. Mantri Panhala, 00.468; On the way to Amboli from Ajra, 10.10.2000, 00.204. Pune District Durgwadi, 2.9.2003, U.V. Makhija & B.C. Behera, 03.281, 03.282, 03.294, 03.303, 03.318, 03.330; Amby Valley ahead of Lonwala, 5.8.2003, B.C. Behera & B.A. Adawadkar, 03.262, 03.265; Purandar; 73.113; Sinhagad, 4.7.2003, U.V. Makhija & N. Verma, 03.19, 03.20. Satara District, Mahabaleshwar, on the way to Arthur Seat 74.1741, 70.18B; Lingmala, 15.7.2003, B.C. Behera & A.V. Dube, 03.136, 03.138, 03.139, 03.140, 03.141, 03.144, 03.147, 03.148, 03.151, 03.153, 03.154, 03.158, 29.9.2003, G.S. Chitale & A.V. Dube, 03.347, 03.351, 03.352, 03.353, 21.1.2004, B.C. Behera & G.S. Chitale, 04.60, 04.61, 04.63, 04.64, 04.65, 04.67, 04.68; Panchgani, Mahabaleshwar, 25.9.2001, U.V. Makhija, 01.37, 01.40, 01.47, 01.49, 29.9.2003, Tata Holiday Home, 03.365, 03.410, 03.481, 03.482.

Heterodermia speciosa (Wulfen) Trevisan *Atti. Soc. Ital. Sci. nat.* 11: 614, 1868 (1869) = *Lichen speciosus* Wulf. In *Jacq. Coll. Bot.* 3: 119 (1789).

Pl. 2, Fig. 6

Thallus corticolous, foliose yellowish-grey to grey, loosely adnate to the substratum, 3-7 cm in diam., 201.6-336 µm thick, repeatedly dichotomously branched; lobes slightly disjunct or adjacent, more or less plane, not ascending, with short lateral lobes, 1-1.5 mm broad; soralia apical on main and lateral lobes producing farinose soredia; upper cortex prosoplectenchymatous, 54.6-75.6 µm thick; algal layer continuous, 25.2-42 µm thick; medulla white, 76-176 µm thick; lower surface corticate, white or brownish, lower cortex prosoplectenchymatous, 21-46 µm thick: sparsely rhizinate, rhizines irregular branched, black.

Apothecia laminal, sessile to substipitate, margin of thalline exciple soredate; disc brownish black, epruinose; epithecium brown, 15-24 µm thick; hymenium hyaline, KI+ blue, 75-90 µm high; hypotehcium pale yellowish 12-17 µm tall; asci simple, cylindrical, long, KI+ blue. Ascospores brown ellipsoidal, pachysporaria type, (21)25-35 (38) x (9) 12-18 µm.

Chemistry—Thallus K+ yellow, C-, KC-, P+ yellow; medulla K+, C-, KC-, P-; atranorin and zeorin present.

Habitat—Growing on trees in open places along the road sides.

Distribution—India (Himalaya, Maharashtra, Manipur, Nagaland, Uttar Pradesh, and West Bengal). Australia, Canada, Florida, New Zealand, North America. Worldwide in tropics, cosmopolitan.

Remarks—*Heterodermia speciosa* is being reported for the first time from Maharashtra and is distinguished from *H. pseudospeciosa* (Kurok.) W. Culb. by the presence of farinose soredia and absence of norstictic and salazinic acids in its thallus.

Specimens examined—Maharashtra, Pune District, Durgawadi, 2.9.2003, U.V. Makhija & G.S. Chitale, 03.328, 03.248, 03.300, 03.304, 03.306, 03.309; Tahmini Ghat, 7.10.2003, B.C. Behera & A. Sonone, 03.468; Sinhagad, 4.7.2003, A.V. Dube & G.S. Chitale, 03.9, 03.11, 03.12, 03.21, 03.60, 03.62. Satara District, Lingmala, 15.7.2003, B.C. Behera & N. Verma, 03.143; Gureghar, 15.7.2003, A.V. Dube

& G.S. Chitale, 03.157, 03.180; Panchgani, Tata Holiday Home, 29.9.2003, G.S. Chitale & A.V. Dube, 03.358, 03.409; Lingmala, 21.1.2004, B.C. Behera & G.S. Chitale, 054.66, 04.69.

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