FUNGI AND DISEASES OF ERYTHROXYLUM

BY

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This is a report on the occurrence and pathogenicity of 54 fungi and a witches'-broom on Erythroxylum. Records for preparation of the report were assembled by the staff of the Mycology Laboratory. Detailed supporting data have been assimilated and condensed for preparation of this report.

The genus Erythroxylum includes perhaps 200 species situated principally in Central and South America and the West Indies, and also in Africa, Madagascar, Southern Asia and the Southern Pacific area (Schulz, 1907; Willis, 1966). Most familiar is E. coca Lam., a native South American plant from which cocaine is extracted (Rogers, 1963). Although E. coca is thus economically significant, little is known about its diseases or those of other species in the genus. The literature of phytopathology includes few references specifically to pathogens of Erythroxylum, and no comprehensive account. This void is filled by the following report based on information obtained from abstract-journals; mycological and phytopathological books and journals; data files of the Plant Pathogens Index in the National Fungus Collections (BPI); and herbarium collections, also in BPI. Abstract-journals that were consulted include Abstracts of Mycology, Bibliography of Agriculture, Biological Abstracts, Horticultural Abstracts, Review of Applied Mycology, and Review of Plant Pathology. Also, P. A. Saccardo's Sylloge Fungorum (1882-1931) and the Phytopathology Index of the National Agricultural Library were surveyed. Distribution and other records not accompanied by literature citations were derived from data available in the Plant Pathogens Index or herbarium. The following discussion is presented in six sections based primarily on characteristics of disease production.

SECTION I: WITCHES'-BROOM

1. ESTALLA (WITCHES'-BROOM)

Occurrence: E. coca - Bolivia.

Witches'-broom of coca is discussed in papers by Cardenas. Originally (1944), he suggested that the disease resulted from physiological disturbances, perhaps involving a virus. Later (1948), Cardenas seemed convinced that a virus was responsible, with a small, black aphid as the vector. The disease transforms leaves into reduced, scaly structures compactly grouped as a witches'-broom. Further information is needed before the importance of this disease can be determined.

SECTION II: THREAD-BLIGHT AND CORTICIOID PATHOGENS

2. CORTICIUM INVISUM Petch, Roy. Bot. Gard. Peradeniya Ann. 9: 316. 1925.

Occurrence: E. coca - Ceylon.
Camellia sinensis (L.) Ktze. - Ceylon.
Oxyanthus tubiflorus DC. - Ceylon

Petch (1921, 1922) originally referred this fungus to C. theae Bernard, which may belong in the genus Thanatephorus (with Rhizoctonia hyphal stages). Later (1923, 1924), he decided that the Ceylon fungus was not C. theae and he finally (1925) named it as C. invisum. According to Donk (1958), C. invisum seems much like Koleroga noxia Donk (Pellicularia koleroga Cke.), a pathogenic thread-blight fungus on many hosts in the Tropics. At present, C. invisum must be regarded as possibly synonymous with K. noxia. In Ceylon, it causes a black rot of coca and tea plants.

3. CORTICIUM PERVAGUM Petch, Roy. Bot. Gard. Peradeniya Ann. 9: 316. 1925.

Occurrence: E. coca - Ceylon.

According to Talbot (1965), the original description of C. pervagum can be interpreted as characterizing a species of Ceratobasidium. Petch (1925) described the fungus as parasitic, with hyphae overrunning and killing leaves and twigs.

Donk (1958) wrote that it may be close to Koleroga noxia, which causes thread-blights of tropical plants. Regardless of its precise identity, C. pervagum apparently is a thread-blight fungus. Although harmful to crop production, thread-blight can be controlled by copper sprays (Theis et al., 1959).

4. CORTICIUM SALMONICOLOR Berk. & Br., Linn. Soc. Bot. J. 14: 71. 1875.

Synonymy: Botryobasidium salmonicolor (Berk. & Br.) Venkatarayan, Indian Phytopath. 3: 82. 1950.
Pellicularia salmonicolor (Berk. & Br.) Dastur, Current Sci. 15: 193. 1946.
Corticium zimmermanii Sacc. & Syd., in Sacc., Syll. Fungorum 16: 1117. 1902.
Corticium javanicum Zimmerm., Centralbl. Bakt. 7: 103. 1901; non C. javanicum (P. Henn.) Sacc. & Syd., in Sacc., Syll. Fungorum 16: 189. 1902.

Occurrence: E. coca - South America; Ceylon, Java.
Many hosts - Ubiquitous in tropical areas.

This fungus causes "pink disease" on branches, twigs, and leaves of many tropical plants. According to Fröhlich and Rodewald (1963), who wrote about pink disease of rubber trees, control can be accomplished with copper sprays, or the affected parts of plants may be removed.

5. HYPOCHNUS ERYTHROXYLI Sawada, Natl. Taiwan Univ. Col. Agr. Spec. Publ. 8. p. 100-101. 1959.

Occurrence: E. coca - Taiwan.

This fungus is known only from Sawada's description (1959). Probably it is a species of Thanatephorus, thus close to T. cucumeris (Frank) Donk (Rhizoctonia solani Kühn) and Pellicularia sasakii (Shirai) S. Ito. According to Sawada, it attacks the basal parts of young coca seedlings. Sclerotia develop on the lesions and fruiting areas appear farther above soil level.

6. PELLICULARIA SASAKII (Shirai) S. Ito, Mycol. Fl. Japan 2(4): 107. 1955.

Synonymy: Pellicularia filamentosa (Pat.) Rogers f. sp. sasakii (Shirai) Exner, Mycologia 45: 717. 1953.
Corticium sasakii (Shirai) Matsumoto, Sapporo Nat. Hist. Soc. Trans. 13: 119. 1934.
Hypochnus sasakii Shirai, Bot. Mag. Tokyo 20: 319. 1906.

Occurrence: E. coca - India, Japan, Java, Philippines, Taiwan.
Many hosts - Louisiana; India, Japan.

This is a thread-blight type of fungus that causes a so-called "banded sclerotial disease" of leaves. Donk (1958) placed it in the genus Thanatephorus together with T. cucumeris, the basidial stage of Rhizoctonia solani. R. solani is a well-known pathogen which is particularly troublesome because of its ability to form sclerotia that persist in the soil as infective agents. Sawada (1959) said that P. sasakii does not produce sclerotia, but Butler (1918), Matsumoto (1934) and Exner (1953) all mentioned sclerotial formation by fungi identified as P. sasakii.

SECTION III: RUST FUNGI

7. BUBAKIA ERYTHROXYLONIS Cumm., Mycologia 48: 601. 1956.

Synonymy: Bubakia erythroxylonis (Graz.) Cumm., Torrey Bot. Club Bull. 67: 69. 1940, nom. nud.
Uredo erythroxylonis Graz., Soc. Mycol. France Bull. 7: 152. 1891; as U. erythroxyli Graz., in Sacc., Syll. Fungorum 11: 224. 1895.

Occurrence: E. coca - Argentina, Bolivia, Colombia, Costa Rica, Ecuador, Panama, Peru; possibly Brazil, Cuba Puerto Rico, Venezuela.
E. spp. - Bolivia, Brazil, Cuba, Dominican Republic, New Guinea, Puerto Rico, Venezuela, Virgin Islands.

Cummins (1939) reported Bubakia sp. on Erythroxylum from Central and South America and New Guinea. Apparently this is the same fungus that he later (1940) recognized as B. erythroxylonis. Arthur (1918) said that the uredial stage is common wherever coca is cultivated. According to Bues (1914), the disease develops slowly and results in yellowing of leaves and premature defoliation. Spegazzini (1920) found the rust

on 1-2 percent of leaves that he examined. Although the fungus is well established throughout much of the area in which Erythroxylum grows, apparently it does not represent a serious threat to host plants in South America.

8. CRONARTIUM GILGIANUM P. Henn., Engler's Bot. Jahrb. 22: 83. 1895.

Synonymy: Cronartium bresadoleanum P. Henn., in Engler, Die Pflanzenwelt Ostafrikas und der Nachbargebiete, Teil C, p. 51. 1895.

Occurrence: E. sp. - Tropical Africa.
Euclea sp. - Tropical Africa.
Royena sp. - Tropical Africa.

This rust is capable of causing moderately severe spotting of leaves, with abundant production of teliosori. Apparently it occurs on several hosts in Africa, but information about its importance is lacking.

9. PUCCINIA ERYTHROXYLI Viegas, Bragantia 3: 53-54. 1943.

Synonymy: Chaconia erythroxyli (Viegas) Viegas, Indice Fungos America do Sul p. 405. 1963, without reference to original publication.

Occurrence: E. suberosum St. Hil. - Brazil.

Figure 6 of Viegas (1943) shows that the teliospores of this rust are 2-celled, as in Puccinia. According to Mains (1938), teliospores of Chaconia are 1-celled. Thus the rust that Viegas described should be retained in Puccinia. P. erythroxyli is quite unlike Bubakia erythroxylonis, the common rust of Erythroxylum. Only the teliospore stage is known and further studies are required for determination of pathogenesis.

SECTION IV: OTHER SIGNIFICANT PATHOGENS

Deuteromycetes (Nos. 10-15)
Ascomycetes (Nos. 16-21)
Basidiomycetes (Nos. 22-24)

10. CERCOSPORA ERYTHROXYLONIS Gov. & Thirum., Sydowia 9: 221. 1955.

Occurrence: E. monogynum Roxb. - India.

Leaf spots develop mostly on the lower surface. Govindu and Thirumalachar (1955) found no record of any other Cercospora on Erythroxylaceae. Although Cercospora is an asexual stage of Mycosphaerella, no relationship has been found between C. erythroxylonis and M. erythroxyli (Speg.) Morelet, which occurs on E. coca in South America. Until shown otherwise, every Cercospora must be regarded as a potentially significant pathogen. Various species cause diseases of economically important plants, including Sigatoka of bananas, yellow spot of sugarcane, and frog-eye leaf spot of soybean.

11. CERCOSPORELLA COCAE Speg., Soc. Cient. Argentina An. 90: 31. 1920.

Occurrence: E. coca - Argentina.

Spegazzini (1920) considered C. cocae as an asexual stage of Sphaerella erythroxyli Speg. See additional discussion under Mycosphaerella erythroxyli (No. 16).

12. COLLETOTRICHUM COCAE Speg., Soc. Cient. Argentina An. 90: 31. 1920.

Occurrence: E. coca - Argentina.

According to Spegazzini (1920), C. cocae is an asexual stage of Sphaerella erythroxyli, but Arx (1957) reported that it is synonymous with C. gloeosporioides Penz., a well-known and ubiquitous plant pathogen. See additional discussion under Mycosphaerella erythroxyli (No. 16).

13. GLOEOSPORIUM sp.

Occurrence: E. coca - South America; Java.

The South American record is by Viegas (1961), and it consists only of the host listing. The report from Java (Hall, 1925) is more significant, for it refers to a loss of up to 50 percent of seedlings. Since Hall also mentioned "Gloeosporium?"

and "Gloeosporium-type" infection, the identity of the fungus is uncertain. "Gloeosporium" could be a form of Colletotrichum gloeosporioides, but this cannot be determined on the basis of literature records.

14. PHYLLOSTICTA ERYTHROXYLONIS Graz., Soc. Mycol. France Bull. 7: 154. 1891.

Occurrence: E. coca - Bolivia, Colombia, Peru.

At the time that he described Mycosphaerella erythroxyli (as Sphaerella), Spegazzini (1920) cited P. erythroxylonis as an asexual stage. Various species of Phyllosticta are leaf-spot pathogens, and some are asexual stages of Mycosphaerella. See additional discussion under Mycosphaerella erythroxyli (No. 16).

15. PHYLLOSTICTA? LEPTOSPERMA Speg., Mus. La Plata Rev. 15: 33. 1908.

Occurrence: E. suberosum - Brazil.

The significance of this fungus as a pathogen is unknown. Before any assessment can be made, P. leptosperma must be studied taxonomically.

16. MYCOSPHAERELLA ERYTHROXYLI (Speg.) Morelet, Soc. Sci. Nat. Archeol. Toulon Var Ann. 20: 105. 1968.

Synonymy: Sphaerella erythroxyli Speg., Soc. Cient. Argentina An. 90: 27. 1920.

Occurrence: E. coca - Argentina.

According to Spegazzini (1920), M. erythroxyli is the ascigerous stage of Phyllosticta erythroxylonis (as P. erythroxyli), Cercosporella cocae, and Colletotrichum cocae. Arx (1957) cited Colletotrichum cocae as a synonym of C. gloeosporioides, which is an asexual stage of the ascigerous fungus Glomerella cingulata (Stonem.) Spauld. & Schrenk. However, ascospores of Glomerella are 1-celled; those of Mycosphaerella are 2-celled, as noted by Spegazzini for M. erythroxyli. Either Spegazzini was mistaken in relating Colletotrichum cocae to M. erythroxyli or Arx was misinformed when he referred C. cocae to C. gloeosporioides.

17. NECTRIA ERYTHROXYLIFOLIAE Viegas, Bragantia 3: 52. 1943.

Occurrence: E. campestre St. Hil. - Brazil.
E. suberosum - Brazil.

Relatively few species of Nectria are serious plant pathogens, usually as a cause of stem cankers. According to Viegas (1943), N. erythroxylifoliae causes grayish-red spots on the upper surface of the coca leaves. Parasitism was described as weak and perhaps secondary.

18. PHYLLACHORA ERYTHROXYLINA Petrak, in Sydow and Petrak, Ann. Mycol. 27: 32. 1929.

Occurrence: E. lucidum H.B.K. - Costa Rica.

This fungus is an ascomycete of the order Sphaeriales. It forms black fruiting bodies on the host leaves. Damage is limited essentially to leaf areas on which the ascocarps develop.

19. PHYLLACHORA USTERIANA Speg., Mus. La Plata Rev. 15: 25. 1908.

Synonymy: Phyllachora erythroxyli Viegas, Soc. Brasil. Agronom. Bol. 7(2): 61-62. 1944.

Occurrence: E. suberosum - Brazil.

The pathogenic attributes of this fungus are similar to those of P. erythroxylina.

20. PROTOMYCES? COCAE Speg., Soc. Cient. Argentina An. 90: 29-30. 1920.

Occurrence: E. coca - Argentina.

By use of a question mark, Spegazzini (1920) indicated that he was uncertain about a genus name for this fungus. Protomyces is not well understood. According to Ainsworth (1971), it belongs in the hemiascomycetous order Protomycetales, together with Taphridium and Protomycopsis. Heim (1967) reported that it is allied with the Chytridiales. The position of the genus was discussed also by Gjaerum (1964). The original description of P. cocae suggests that its pathological effects are similar to those of P. macrosporus Unger, a species

that parasitizes Aegopodium podograria L. According to Butler and Jones (1949), P. macrosporus causes "a simple stem gall... where there is a hyperplasy of the outer cortical cells, restricted to those in the neighbourhood of the intercellular hyphae."

21. XYLARIA APICULATA Cke., Grevillea 8: 66. 1879.

Synonymy: Xylaria cookei Lloyd, Mycol. Notes 5, Large Pyrenomycetes p. 25. 1919.
Xylaria venosula Speg., Acad. Nac. Cienc. Cordoba Bol. 11: 133. 1889.

Occurrence: E. coca - Brazil, Dominican Republic, Puerto Rico, Trinidad; also Ceylon, China, Java, Rhodesia.
Hevea brasiliensis (Willd ex A. Juss.) Muell.-Arg. - Ceylon.
Solanum tuberosum L. - Florida.
Other hosts - Brazil, Dominican Republic, Trinidad; also New Zealand.

Steinmann (1928) reported that X. apiculata was associated with dying coca plants in central Java, and that it seemed responsible for their deaths. A black hyphal mass covered roots and stem bases, and ascocarps of the Xylaria developed on stem bases near soil level. A few other pathogenic kinds of Xylaria are known, including X. mali Fromme on apple and X. thwaitesii Berk. & Cke. on coffee and rubber. Dissemination of X. apiculata apparently is by means of hyphal strands that grow through the soil and enter host roots.

22. ARMILLARIELLA MELLEA (Vahl ex Fr.) Karst., Flor. Faun. Fenn. Acta 2(1): 4. 1881.

Synonymy: Armillaria putrida Murr., N. Am. Fl. 10: 39. 1914.
Armillaria mellea (Vahl ex Fr.) Quél., Champ. Jura Vosges p. 75. 1872.
Agaricus melleus Fr., Syst. Mycol. 1: 30. 1821.

Occurrence: E. coca - South America.
Many hosts - Ubiquitous in tropical areas.

According to Smith (1949), A. mellea may be either saprobic or parasitic. Singer (1962) reported that A. mellea and the closely related A. tabescens (Scop. ex Fr.) Sing. are important pathogens of trees, and that they also damage crops such as

peanuts and sweet potatoes. A. mellea produces extensive black rhizomorphs, which facilitate dissemination within local areas. Rhizomorphs also develop in culture (Snider, 1959), and presumably they could serve as a convenient form of mass inoculum for infection experiments.

23. MYCENA CITRICOLOR (Berk. & Curt.) Sacc., Syll. Fungorum 5: 263. 1887.

Synonymy: Mycena flavida (Maubl. & Rangel) Sing., Lilloa 22: 357. 1951.
Omphalia flavida Maubl. & Rangel, Soc. Mycol. France Bull. 30: 46. 1914.
Stilbum flavidum Cke., Grevillea 9: 11. 1880.
Agaricus (Mycena) citricolor Berk. & Curt., Linn. Soc. Bot. J. 10: 285. 1869.

Occurrence: E. coca - Peru; Soviet Union.
Coffea - Brazil, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Guiana, Jamaica, Mexico, Puerto Rico, Trinidad, Venezuela; West Africa.
Many hosts - Brazil, Colombia, Costa Rica, Peru, Venezuela.

This fungus causes a relatively well-known disease of coffee bushes in South America. The Stilbum stage appears on leaves in the form of detachable "gemmae" (Butler and Jones, 1949) that serve as the primary method of dissemination. Severe infection causes shedding of leaves and berries. The perfect stage is a small mushroom that develops in culture but not on the host (Brooks, 1953). Buller (1934) wrote a detailed description of this fungus and called it an extreme example of a nonspecialized parasite.

24. FOMES NOXIUS Corner, Straits Settlements Gard. Bull. 5: 342. 1932.

Synonymy: Phellinus lamaensis (Murr.) Heim, in Pascalet, Ann. Crypt. Exot. 7: 21. 1934, sensu auctt., non typis.
Fomes lamaensis (Murr.) Sacc. & Trott., in Sacc., Syll. Fungorum 21: 287. 1912, sensu auctt., non typis.
Pyropolyporus lamaensis Murr., Torrey Bot. Club Bull. 34: 479. 1907, sensu auctt., non typis.

Hymenochaete noxia Berk., in Cke., Grevillea 8: 149. 1880.

Occurrence: E. coca - Ceylon, Java, Taiwan.
Many hosts - Ubiquitous in tropical areas of Africa, Asia, western and southwestern Pacific Islands; occasionally found in South America.

Brown root rot of many economically important tropical woody plants is caused by F. noxius. According to Corner (1932), the identity of this fungus is thoroughly confused with that of the saprobic F. lamaensis. Corner referred all pathogenic collections to F. noxius. A discussion of F. noxius by Fröhlich and Rodewald (1963) includes the comment that this fungus can kill young plants within a few months.

SECTION V: FLY-SPECK AND SOOTY-MOULD FUNGI

This section includes 24 species of leaf-inhabiting fungi that cause very little damage to their hosts. They belong in various ascomycete orders, including Meliolales, Microthyriales, Asterinales, and Pseudosphaeriales.

25. AMAZONIA ERYTHROXYLI Hansford, Sydowia 11: 46. 1957.

Occurrence: E. sp. - Jamaica.

26. ASTERINA SP.

Occurrence: E. lucidum - South America (Viegas, 1961).

27. BRENESIELLA ERYTHROXYLI Syd., in Sydow and Petrak, Ann. Mycol. 27: 16. 1929.

Occurrence: E. lucidum - Costa Rica.

28. DIMERIELLA SP.

Occurrence: E. sp. - Brazil (Viegas 3693 in BPI).

29. HYMENIOPELTIS ERYTHROXYLI Batista & Vital, in Batista, Soc. Biol. Pernambuco An. 16(1): 147. 1959.

Occurrence: E. sp. - Brazil.

This is a conidial leaf-inhabiting fungus in the family Leptostromataceae of the order Sphaeropsidales. Its fruiting body resembles those of the ascomycete order Microthyriales. It is essentially harmless.

30. MELIOLA ERYTHROXYFOLIAE Batista & Vital, IV Congr. Nac. Soc. Bot. Brasil An. p. 105. 1953.

Occurrence: E. sp. - Brazil.

31. MELIOLA ERYTHROXYLONIS Ciferri, Mycopath. Mycol. Appl. 7: 127. 1954.

Occurrence: E. urbanii O. E. Schulz - Dominican Republic.

32. MICROPELTIS ERYTHROXYLINA Batista & Lima, in Batista, Monogr. Fung. Micropelt. p. 89-91. 1959.

Occurrence: E. sp. - Brazil.

33. MICROPELTIS GRAVATAENSIS Batista & Vital, in Batista, Monogr. Fung. Micropelt. p. 99-102. 1959.

Occurrence: E. sp. - Brazil.

34. MICROPELTIS PSEUDO-OSTIOLATA Batista, Monogr. Fung. Micropelt. p. 134-135. 1959.

Occurrence: E. sp. - Brazil.

35. MICROPELTIS SELECTA Batista & Lima, in Batista, Monogr. Fung. Micropelt. p. 141. 1959.

Occurrence: E. sp. - Brazil.

36. MICROTHYRIELLA ERYTHROXYLI (Batista & Vital) Batista, Monogr. Fung. Micropelt. p. 360. 1959.

Synonymy: Dictyopeltis erythroxyli Batista & Vital, IV Congr. Nac. Soc. Bot. Brasil An. p. 117. 1953.

Occurrence: E. pelleterianum St. Hil. - Brazil.

37. MICROTHYRIELLA ERYTHROXYLIANA Batista & Lima, in Batista, Monogr. Fung. Micropelt. p. 359-360. 1959.

Occurrence: E. sp. - Brazil.

38. MICROTHYRIELLA SCUTELLIFORME (Rehm) Theissen, Broteria, Bot. Ser., 12: 96. 1914.

Synonymy: Clypeolum scutelliforme Rehm, Hedwigia 37: 322. 1898.

Occurrence: E. pelleterianum - South America.

39. PARAPELTELLA ERYTHROXYLI Batista, Monogr. Fung. Micropelt. p. 286-287. 1959.

Occurrence: E. sp. - Brazil.

40. PARASTERINA BATISTAE Maia & Arx, in herb.

Occurrence: E. pelleterianum - Brazil (Maia 20102 in BPI).

41. PARODIELLA MELIOLOIDES (Berk. & Curt.) Cke. Grevillea 13: 106. 1885.

Synonymy: Nectria megalospora Sacc. & Berl., Rev. Mycol. 7: 157. 1885.
Rosellinia melioloides (Berk. & Curt.) Sacc., Syll. Fungorum 2: 276. 1883.
Sphaeria melioloides Berk. & Curt., Linn. Soc. Bot. J. 10: 387. 1869.

Occurrence: E. pulchrum St. Hil. - South America.

42. PARODIELLA PARAGUAYENSIS Speg., Soc. Cien. Argentina An. 18: 285. 1884.

Occurrence: E. ovalifolium Peyritsch - Brazil.
Evolvulus sp. - Paraguay.

Sydow and Petrak (1931) reported the occurrence of this fungus in the Philippines, and several varieties have also been described. The relationships of these with Spegazzini's fungus are uncertain.

43. SCOLECOPELTIDIUM ERYTHROXYLI Batista & Lima, in Batista, Monogr. Fung. Micropelt. p. 195-196. 1959.

Occurrence: E. sp. - Brazil.

44. SEYNESIA PIRAGUENSIS Speg., Soc. Cien. Argentina An. 19: 256. 1885.

Occurrence: E. pulchrum - South America (Viegas, 1961).
Lauraceae - Brazil.

45. SPEGAZZINIELLA ERYTHROXYLIANA Batista, Monogr. Fung. Micropelt. p. 343. 1959.

Occurrence: E. sp. - Brazil.

46. SPEGAZZINIELLA ERYTHROXYLICOLA Batista & Lima, in Batista, Monogr. Fung. Micropelt. p. 344. 1959.

Occurrence: E. sp. - Brazil.

47. SPEGAZZINIELLA FIMBRIATA Batista, Mongr. Fung. Micropelt. p. 345. 1959.

Occurrence: E. sp. - Brazil.

48. STOMIOPELTIS SUTTONIAE (Mendoza) Luttrell, Mycologia 38: 587. 1946.

Synonymy: Stomiopeltella suttoniae Mendoza, Bot. Gaz. 79: 292. 1925.

Occurrence: E. sp. - Brazil (Batista, 1959).

49. THYROSOMA PULCHELLUM Syd., Ann. Mycol. 19: 307. 1921

Occurrence: E. ecarinatum Burck - Indonesia.

SECTION VI: SAPROBIC AND ENTOMOGENOUS FUNGI

50. ASCHERSONIA TURBINATA Berk., Nat. Hist. Ann., Ser. 2, 9: 192. 1852.

Occurrence: E. coca - Bolivia.
Insects - South America and West Indies; Florida.

This is an entomogenous fungus. The ascomycete stage of this conidial form is Hypocrella turbinata Petch.

51. ASPERGILLUS CINEREUS Speg., Soc. Cient. Argentina An. 10: 162. 1880.

Occurrence: E. coca - Argentina.

Spegazzini (1920) reported that this fungus grows on poorly dried leaves of coca. According to Raper and Fennell (1965), it is a conidial fungus, but not identifiable.

52. CLAVULINA LEVEILLEI (Sacc.) Overeem, Jard. Bot. Buitenzorg Bull., Ser. 3, 5: 260. 1923.

Synonymy: Clavulina fusco-lilacina (Berk.) Overeem, sensu Overeem, non typis, Jard. Bot. Buitenzorg Bull., Ser. 3, 5: 262. 1923.
Clavaria fusco-lilacina Berk., sensu Overeem, non typis, Jard. Bot. Buitenzorg Bull., Ser. 3, 5: 262. 1923.
Clavaria leveillei Sacc., Syll. Fungorum 6: 709. 1888.

Occurrence: E. coca - Java.

This fungus probably is not a pathogen. According to Corner (1950), it grows on the ground in the forests of Java and Malaya. Steinmann (1928) reported its occurrence as a saprobe on diseased roots of coca in central Java. It belongs in the basidiomycete order Polyporales.

53. HYPOCHNUS RUBROCINCTUS Ehrenb., Nees's Horae Physic. Berolinensis p. 84. 1820.

Occurrence: E. coca - Venezuela.

This fungus was reported on coca by Bues (1914). No other such report exists, and this species is now considered as a lichen.

54. HYPOCRELLA PALMAE (Berk. & Curt.) Sacc., Syll. Fungorum 2: 580. 1883.

Synonymy: Hypocrea palmae Berk. & Curt., Acad. Nat. Sci. Philadelphia J., Ser. 2, 2: 285. 1851.

Occurrence: E. coca - Peru.
Insects - South America and West Indies.

This is an entomogenous fungus. It is not harmful to plants.

55. RAVENELULA BOLIVIENSIS Speg., Soc. Cient. Argentina An. 90: 28-29. 1920.

Occurrence: E. coca - Bolivia.

Spegazzini's (1920) description indicates that this fungus develops from dead wood of the coca plant. It is a discomycete of the order Helotiales. It should not be confused with Ravenelia, which is a rust genus.

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