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# A review of *Cephaleuros* in Taiwan, with description of *C. parasiticus* on Asian pear tree as a new record

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## ABSTRACT

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Filamentous algae in the genus *Cephaleuros* that caused algal spot diseases were obtained for the morphological and molecular characterization. A recent collection on Asian pear tree (*Pyrus pyrifolia*) in Taiwan was identified as *C. parasiticus*. The 18S rDNA, ITS, and rbcL barcode sequences of the alga on *P. pyrifolia* were nearly identical to those on another host, *Ficus pumila* var. *awkeotsang*, found nearby. Using the rbcL DNA which showed great phylogenetic resolution, the sequences formed a monophyletic cluster with those of *C. parasiticus* from America. To our knowledge, this is the first record of *C. parasiticus* on *P. pyrifolia* in Taiwan. Reviewing the literature related to the algal leaf spot diseases in Taiwan, *Cephaleuros* has been reported on 241 plant species in 68 families in the island. They were most frequently found on the plant family Lauraceae, followed by Theaceae and Fagaceae. Most of the hosts were forest trees and some were economic crops. Although only *C. virescens* has been previously reported in Taiwan, this study suggests that *Cephaleuros* is more diversified in this region.

Keywords: *Cephaleuros*, parasitic algae, algal leaf spot disease, Trentepohliaceae, forest biodiversity, special crops

## INTRODUCTION

Filamentous algae in the genus *Cephaleuros*, belonging to the family Trentepohliaceae (Chlorophyta, Ulvophyceae), are known to be parasitic or endophytic on land plants in tropical, subtropical and temperate regions worldwide [34, 38, 39]. The algae can produce reddish orange thalli on leaves and twigs of many plants, causing algal spot diseases with chlorosis, cankers, and dieback symptoms [17] and some of them are lichenized [17, 34]. Currently, more than 17 *Cephaleuros* species are recognized [17] and there are 19 accepted names in AlgaeBase (https://www.algaebase.org/) [21]. Among them, *C. virescens* is the most frequently recorded [18, 19, 32] while *C. parasiticus* is an emerging threat to cultivated crop plants [19, 31, 33].

In Taiwan, little attention had been paid to the algal spot diseases until Huann-Ju Hsieh, the late Associate Professor of Department of Plant Pathology and Microbiology, National Taiwan University, collected and reported *C. virescens* on a wide variety of forest trees around the island between the 1970s-1990s. Although the information is limited in the database [19], *Cephaleuros* is widely distributed in Taiwan according to Hsieh [23] and our observation. During our survey of plant diseases on Asian pear tree in central Taiwan [1], algal spot diseases were found on the leaves of the fruit trees and other plants in the vicinity. Therefore, the present study attempted to (1) obtain the morphological and molecular characteristics of the *Cephaleuros* based on our recent collections and (2) review the literature and provide a list of host plants where *Cephaleuros* are found in Taiwan.

## MATERIALS AND METHODS

### Morphological characteristics of *Cephaleuros* on Asian pear tree

Leaves of Asian pear tree (*Pyrus pyrifolia* (Burm.f.) Nakai) (cultivar Hengshan) with algal leaf spots were collected in commercial pear orchards in Dongshi, Taichung. The morphological

characteristics were determined with the aid of light microscope (Leica). The orange algal tissues were mounted in water on glass slides for observation. A total of 50 sporangia were measured. A voucher specimen was deposited at the herbarium of National Museum of Natural Science, Taichung, Taiwan (TNM F0024061).

### Molecular characterization

Samples of *Cephaleuros* on Asian pear tree and awkeotsang (*Ficus pumila* var. *awkeotsang* (Makino) Corner) (in Dongshi, Taichung as well, near an Asian pear orchard) were collected for DNA extraction. Extraction of algal DNA was adapted from Virtudazo et al. [36]: small amount of algal tissue was crushed by using two sterile glass slides and suspended in 20 µl buffer [36]. The suspension was incubated under 37 ˚C for 60 min and then at 95 ˚C for 10 min.

To conduct the polymerase chain reactions (PCR) covering three DNA regions, four existing primer pairs targeting *Cephaleuros* or algal partners of lichens were used for the amplification of each sample: Tre18S_N1_for / CHtrente1.rev [22] for the partial 18S ribosomal RNA gene (18S rDNA), CHtrente1.for [22] / ITS4 [37] and nr-SSU-1780-5'Algal [28] / ITS4T [24] for sequences covering the internal transcribed spacer (ITS) regions, and a-ch-rbcL-203-5'-MPN / a-ch-rbcL-991-3'-MPN [27] for the chloroplast-encoded large subunit of the ribulose-1,5-bisphosphate carboxylase/oxygenase (rbcL) gene. PCR reaction for the 18S rDNA and ITS sequences was performed with an initial denaturation at 95˚C for 2 min, followed by 35 cycles of denaturation at 95˚C for 30 s, primer annealing at 55˚C for 30 s, and DNA extension at 72˚C for 2 min, and a final extension at 72˚C for 5 min. The rbcL DNA were amplified with an initial denaturation at 95˚C for 5 min, followed by 40 cycles of denaturation at 95˚C for 1 min, primer annealing at 50˚C for 1 min, and DNA extension at 72˚C for 1 min, and a final extension at 72˚C for 7 min. The amplicons were sequenced from both ends by Tri-I Biotech, Inc., New Taipei. The resulted sequences were analyzed using Basic Local Alignment Search Tool (BLAST) (http://www.ncbi.nlm.nih.gov/) and then deposited in Genbank.

For phylogenetic analyses, sequences with closer relationship were retrieved from Genbank and aligned with those obtained in this study using MAFFT version 7 (https://mafft.cbrc.jp/alignment/software/). Reconstruction of individual and concatenated phylogenetic trees were generated using MEGA X (https://www.megasoftware.net/) by maximum-likelihood (ML) method under general time reversible model with gamma distribution and invariant sites (GTR+G+I) and 1,000 bootstrap replications.

### Records of *Cephaleuros* on host plants in Taiwan

In order to have a full record of host range of *Cephaleuros* currently known in Taiwan, literature related to the algal leaf spot diseases were reviewed. Most of the records were from the works of Huann-Ju Hsieh between 1980-2001. Others were from book series of Plant Protection Illustrated Guide published by the Bureau of Animal and Plant Health Inspection and Quarantine, Taiwan and other resources. The scientific names of the plants follow The Plant List website (http://www.theplantlist.org/) with the references and collection localities listed.

## RESULTS

### Morphological characteristics of *Cephaleuros* on Asian pear tree

The algal thalli were subcuticular and subepidermal (Fig. 1D), yellowish to orange, circular, 1-3 mm in diameter (Fig. 1B), with no discoloration around the thalli. Both sides of the leaves could be infected, mostly on upper surfaces (Fig. 1A). Incidences of the algal spot disease were about 20% in seriously infected orchards. The orange colored velvet-like spots contained long-cylindrical filamentous cells, gametangia, sporangiophores and sporangia (Fig. 1C). The sporangia were ellipsoidal, with an average length and width of 28.8 (17.0 to 35.0) × 22.5 (16.3 to 27.0) µm (n = 50). Biflagellate motile cells were released after adding a drop of water on the thalli. Based on these characteristics, the pathogen is considered as a *Cephaleuros* species [34, 35].

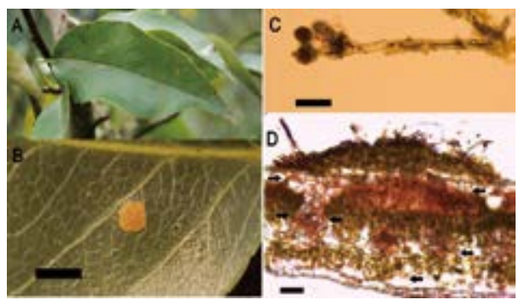


**Fig. 1.** *Cephaleuros parasiticus* on Asian pear trees. (A) Infected leaf showing pustules of algal thalli. (B) An algal thallus on leaf of Asian pear tree (bar = 3 mm). (C) Sporaniga and the sporangiophore (bar = 50 µm). (D) Transverse section of an infected pear leaf, showing subepidermal development of algal filaments (arrows) (bar = 50 µm).



### Molecular identification and phylogenetic analyses

In this study, six sequences of *Cephaleuros* on Asian pear tree and awkeotsang were generated and deposited in GenBank. The 18S rDNA, ITS, and rbcL sequences were MZ470274-MZ470275, MZ474523-MZ474524, and MZ484511-MZ484512, respectively. Base pair similarities of 18S rDNA, ITS, and rbcL gene between the two samples were 100% (756/756), 99.88% (861/862), and 100% (757/757), respectively. BLAST search at GenBank database with the sequences from Asian pear tree had the best matches with those of the American *C. parasiticus* isolate SAG 73.90. The three sequences KM020146, JX866794, and KM464711 from SAG 73.90 showed 100% (756/756), 94.86% (701/739), and 98.94% (749/757) homologies compared with those from Asian pear tree (MZ470274, MZ474523, and MZ484511) generated in this study. Among the three DNA regions, rbcL gene provided the best phylogenetic resolution at the species level (Fig. 2) compared with 18S rDNA and ITS sequences (data not shown). Miltilocus analysis using combined 18S rDNA, ITS, and rbcL sequences placed the *Cephaleuros* from Taiwan in a monophyletic group with *C. parasiticus* SAG 73.90 (Fig. 3). The results indicated our algal collections from Asian pear tree and awkeotsang should be classified as *C. parasiticus*.

### Records of *Cephaleuros* on host plants in Taiwan

According to the literature related to the algal leaf spot disease, *Cephaleuros* is reported on 241 species of plants in Taiwan (Table 1). These hosts belong to 68 plant families, most frequently on Lauraceae, followed by Theaceae and Fagaceae, occupied 13.7%, 8.3%, and 7.5% of all the records, respectively (Fig. 4). The present study identified *C. parasiticus* on Asian pear tree and awkeotsang while other algal spot records in the literature in Taiwan were *C. virescens*.

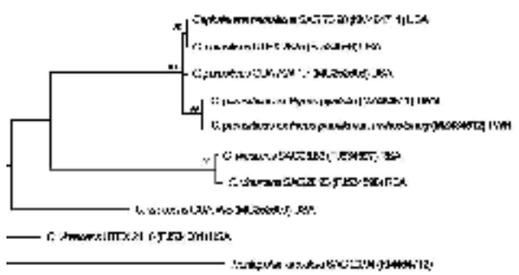

**Fig. 2.** Molecular phylogeny of *Cephaleuros* species based on the ribulose-1,5-bisphosphate carboxylase/oxygenase (rbcL) gene sequences. The phylogenetic tree was generated using the Maximum likelihood method and 1,000 bootstrap replications. The sequences obtained in this study are shown in bold.

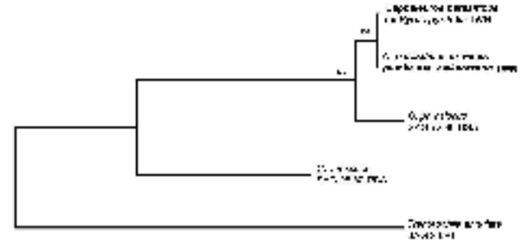

**Fig. 3.** Molecular phylogeny of *Cephaleuros* species based on the concatenated sequences of 18S rDNA, ITS, and rbcL gene. The phylogenetic tree was generated using the Maximum likelihood method and 1,000 bootstrap replications. The sequences obtained in this study are shown in bold.

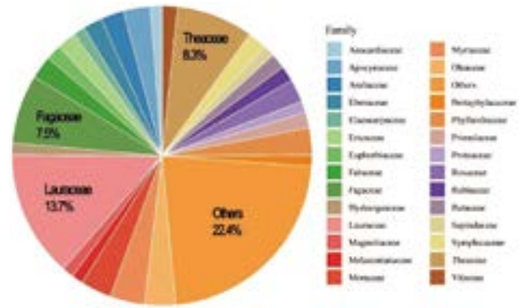


**Fig. 4.** Plant families that are found as hosts of *Cephaleuros* in Taiwan.

### Discussion

This is the first report of *Cephaleuros* parasiticus on *P. pyrifolia* as a new record in Taiwan, supported by both morphological and molecular data. The 18S rDNA, ITS, and rbcL sequences of *Cephaleuros* on *F. pumila* var. *awkeotsang* were almost identical to those on Asian pear tree (only one base pair difference among the three regions). Previously, the 18S rDNA region is widely used in phylogenetic analyses [25, 29, 30, 31, 32, 33]. An isolate of *C. virescens* from Taiwan (culture SAG 42.85) was included in the phylogenetic analysis of 18S rDNA [25]. Although the 18S rDNA sequences obtained in this study were similar to DQ399585 from the culture SAG 42.85 (753/756), the identification differed and this study generated barcode DNA of *C. parasiticus* from Taiwanese specimens for the first time. In the phylogenetic analysis, the rbcL sequences presented here formed a well-supported monophyletic cluster with those of *C. parasiticus* from America [20, 30]. Our results showed rbcL sequences had great phylogenetic

**TABLE 1.** Records of *Cephaleuros* in Taiwan

| Host | Literature[a] | Locality |
|---|---|---|
| Ferns | | |
| Aspleniaceae 鐵角蕨科 | | |
| ***Asplenium nidus*** L.<br>山蘇花 | 謝煥儒、傅春旭:中華林學季刊32(2):139. 1999. | Yuanshan, Yilan |
| Polypodiaceae水龍骨科 | | |
| ***Leptochilus buergerianus*** (Miq.) Bosman<br>波氏星蕨 | 謝煥儒:中華林學季刊23(3):40. 1990. | Jinfeng, Taitung |
| ***Pyrrosia lingua*** (Thunb.) Farw.<br>石葦 | Huann-Ju Hsieh: Botanical Bulletin of Academia Sinica 24:94. 1983. | Renai, Nantou |
| Gymnosperms | | |
| Araucariaceae 南洋杉科 | | |
| ***Araucaria hunsteinii*** K.Schum.<br>亮葉南洋杉 | 謝煥儒、傅春旭:中華林學季刊32(2):138. 1999. | Yuanshan, Yilan |
| Pinaceae 松科 | | |
| ***Keteleeria davidiana*** var. ***formosana*** (Hayata) Hayata<br>臺灣油杉 | 謝煥儒、傅春旭:中華林學季刊32(2):139. 1999. | Yuanshan, Yilan |
| Taxaceae 紅豆杉科 | | |
| ***Amentotaxus formosana*** H.L.Li<br>臺灣穗花杉 | 謝煥儒:中華林學季刊23(3):39. 1990. | Jinfeng, Taitung |
| Angiosperms | | |
| Actinidiaceae 獼猴桃科 | | |
| ***Saurauia tristyla*** DC.<br>水冬哥 | 謝煥儒:中華林學季刊20(1):66. 1987. | Changbin, Taitung |
| Adoxaceae 五福花科 | | |
| ***Viburnum odoratissimum*** Ker Gawl.<br>珊瑚樹 | 謝煥儒:中華林學季刊20(1):66. 1987.<br>謝煥儒、傅春旭:中華林學季刊32(2):139. 1999. | Hengchun, Pingtung; Yuanshan, Yilan |
| Anacardiaceae 漆樹科 | | |
| ***Anacardium occidentale*** L.<br>腰果 | 謝煥儒:中華林學季刊20(1):66. 1987. | Hengchun, Pingtung |
| ***Mangifera indica*** L.<br>芒果 | 謝煥儒:中華林學季刊20(1):66. 1987.<br>謝煥儒、傅春旭、陳吉田:臺大實驗林研究報告14(4): 221-226. 2000.<br>楊宏仁:植物保護圖鑑系列 10:95. 2003. | Hengchun, Pingtung; Zhongzheng, Taipei |
| ***Rhus succedanea*** L.<br>山漆 | 謝煥儒:林試所研究報告445:5. 1985.<br>Huann-Ju Hsieh: Botanical Bulletin of Academia Sinica 24:90. 1983. | Renai, Nantou |
| Annonaceae 番荔枝科 | | |
| ***Artabotrys hexapetalus*** (L.f.) Bhandari<br>鷹爪花 | 謝煥儒、傅春旭、陳吉田:臺大實驗林研究報告14(4): 221-226. 2000. | Zhongzheng, Taipei |
| ***Fissistigma oldhamii*** (Hemsl.) Merr.<br>毛瓜馥木 | Huann-Ju Hsieh: Botanical Bulletin of Academia Sinica 24:90. 1983.<br>謝煥儒:林試所研究報告445:4. 1985. | Renai, Nantou |
| Apocynaceae 夾竹桃科 | | |
| ***Alstonia scholaris*** (L.) R. Br.<br>黑板樹 | 謝煥儒:中華林學季刊20(1):66. 1987.<br>謝煥儒、傅春旭、陳吉田:臺大實驗林研究報告14(4): 221-226. 2000. | Zhushan, Nantou; Zhongzheng, Taipei |
| ***Anodendron benthamianum*** Hemsl.<br>大錦蘭 | 謝煥儒:中華林學季刊20(1):66. 1987. | Hengchun, Pingtung |
| ***Hoya carnosa*** (L.f.) R.Br.<br>毬蘭 | 謝煥儒:林試所研究報告445:4. 1985.<br>謝煥儒、傅春旭:中華林學季刊32(2):139. 1999. | Sandimen, Pingtung; Yuanshan, Yilan |
| ***Tabernaemontana pandacaqui*** Lam.<br>真山馬茶 | 謝煥儒:中華林學季刊23(3):40. 1990. | Hengchun, Pingtung |
| ***Trachelospermum jasminoides*** (Lindl.) Lem.<br>臺灣白花藤 | Huann-Ju Hsieh: Botanical Bulletin of Academia Sinica 24:90. 1983.<br>謝煥儒:林試所研究報告445:5. 1985. | Renai, Nantou; Yuchi, Nantou |
| ***Urceola rosea*** (Hook. & Arn.) D.J.Middleton<br>酸藤 | Huann-Ju Hsieh: Botanical Bulletin of Academia Sinica 24:90. 1983.<br>謝煥儒:林試所研究報告445:3. 1985.<br>謝煥儒、傅春旭:中華林學季刊32(2):138. 1999. | Renai, Nantou; Sandimen, Pingtung; Yuanshan, Yilan |
| ***Cerbera manghas*** L.<br>海檬果 | 謝煥儒、傅春旭、陳吉田:臺大實驗林研究報告14(4): 221-226. 2000. | Zhongzheng, Taipei |
| Aquifoliaceae 冬青科 | | |
| ***Ilex ficoidea*** Hemsl.<br>臺灣糊樗 | 謝煥儒:中華林學季刊23(3):40. 1990.<br>謝煥儒、傅春旭:中華林學季刊32(2):139. 1999. | Jinfeng, Taitung; Wulai, New Taipei; Yuanshan, Yilan |
| ***Ilex wilsonii*** Loes.<br>威氏冬青 | 謝煥儒、傅春旭、陳吉田:臺大實驗林研究報告14(4): 221-226. 2000. | Zhongzheng, Taipei |
| Araceae 天南星科 | | |
| ***Epipremnum pinnatum*** (L.) Engl.<br>柃樹藤 | 謝煥儒:中華林學季刊23(3):40. 1990. | Jinfeng, Taitung |
| ***Pothos chinensis*** (Raf.) Merr.<br>柚葉藤 | 謝煥儒:中華林學季刊23(3):40. 1990.<br>謝煥儒、傅春旭:中華林學季刊32(2):139. 1999. | Jinfeng, Taitung; Yuanshan, Yilan |
| Araliaceae 五加科 | | |
| ***Aralia bipinnata*** Blanco<br>裏白楤木 | 謝煥儒:中華林學季刊23(3):39. 1990. | Jinfeng, Taitung |
| ***Aralia decaisneana*** Hance<br>刺楤 | 謝煥儒:中華林學季刊23(3):39. 1990. | Jinfeng, Taitung |
| ***Dendropanax dentiger*** (Harms) Merr.<br>臺灣樹參 | 謝煥儒:中華林學季刊23(3):40. 1990. | Chunri, Pingtung |
| ***Fatsia polycarpa*** Hayata<br>臺灣八角金盤 | 謝煥儒:中華林學季刊23(3):40. 1990. | Chunri, Pingtung |
| ***Schefflera arboricola*** (Hayata) Merr.<br>鵝掌藤 | 謝煥儒:林試所研究報告445:5. 1985. | Chishang, Taitung |
| ***Schefflera heptaphylla*** (L.) Frodin<br>江某 | Huann-Ju Hsieh: Botanical Bulletin of Academia Sinica 24:90. 1983.<br>謝煥儒:中華林學季刊 16(1):72. 1983.<br>謝煥儒:林試所研究報告445:5. 1985.<br>謝煥儒、傅春旭:中華林學季刊32(2):139. 1999. | Guanxi, Hsinchu; Zhuolan, Miaoli; Renai, Nantou; Yuanshan, Yilan |
| Arecaceae 棕櫚科 | | |
| ***Daemonorops jenkinsiana*** (Griff.) Mart.<br>黃藤 | 謝煥儒:中華林學季刊20(1):66. 1987.<br>謝煥儒、傅春旭:中華林學季刊32(2):138. 1999. | Changbin, Taitung; Yuanshan, Yilan |
| Berberidaceae 小檗科 | | |
| ***Nandina domestica*** Thunb.<br>南天竹 | 謝煥儒、傅春旭、陳吉田:臺大實驗林研究報告14(4): 221-226. 2000. | Zhongzheng, Taipei |
| Burseraceae 橄欖科 | | |
| ***Canarium album*** (Lour.) DC.<br>橄欖 | 謝煥儒:林試所研究報告445:3. 1985.<br>謝煥儒:中華林學季刊23(3):39. 1990. | Zhushan, Nantou |
| Capparaceae 山柑科 | | |
| ***Capparis micracantha*** var. ***henryi*** (Matsum.) M.Jacobs<br>亨利氏山柑 | 謝煥儒:林試所研究報告445:3. 1985. | Sandimen, Pingtung |
| Cardiopteridaceae 心翼果科 | | |
| ***Gonocaryum calleryanum*** (Baill.) Becc.<br>柿葉茶茱萸 | 謝煥儒、傅春旭、陳吉田:臺大實驗林研究報告14(4): 221-226. 2000. | Zhongzheng, Taipei |
| Celastraceae 衛矛科 | | |
| ***Euonymus laxiflorus*** Champ. ex Benth.<br>大丁黃 | 謝煥儒:中華林學季刊20(1):66. 1987. | Changbin, Taitung |
| ***Euonymus tashiroi*** Maxim.<br>菱葉衛矛 | 謝煥儒:中華林學季刊23(3):40. 1990. | Jinfeng, Taitung |
| Chloranthaceae 金粟蘭科 | | |
| ***Sarcandra glabra*** (Thunb.) Nakai<br>紅果金粟蘭 | Huann-Ju Hsieh: Botanical Bulletin of Academia Sinica 24:90. 1983. | Renai, Nantou; Yuanshan, Yilan |

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| | 謝煥儒:林試所研究報告445:5. 1985. | |
| | 謝煥儒、傅春旭:中華林學季刊32(2):139. 1999. | |
| Cyperaceae 莎草科 | | |
| ***Carex baccans*** Nees<br>紅果苔 | 謝煥儒、傅春旭: 中華林學季刊32(2):138. 1999. | Yuanshan, Yilan |
| Daphniphyllaceae 交讓木科 | | |
| ***Daphniphyllum pentandrum*** Hayata<br>奧氏虎皮楠 | Huann-Ju Hsieh: Botanical Bulletin of Academia Sinica 24:90. 1983.<br>謝煥儒:林試所研究報告445:3. 1985. | Renai, Nantou |
| Ebenaceae 柿樹科 | | |
| ***Diospyros discolor*** Willd.<br>毛柿 | 謝煥儒:中華林學季刊20(1):66. 1987. | Hengchun, Pingtung |
| ***Diospyros eriantha*** Champ. ex Benth.<br>軟毛柿 | 謝煥儒:中華林學季刊20(1):66. 1987. | Hengchun, Pingtung |
| ***Diospyros kaki*** L.f.<br>柿 | 葉士財、柯文華: 臺中區農業技術專刊 184:17. 2013. | |
| ***Diospyros maritima*** Blume<br>黃心柿 | 謝煥儒:中華林學季刊23(3):40. 1990. | Hengchun, Pingtung |
| ***Diospyros morrisiana*** Hance<br>山紅柿 | 謝煥儒:中華林學季刊20(1):66. 1987.<br>謝煥儒、傅春旭:中華林學季刊32(2):138. 1999. | Beitou, Taipei; Yuanshan, Yilan |
| Elaeocarpaceae 杜英科 | | |
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[a] The algal spots on the plants in all the literature are recorded as ***Cephaleuros virescens*** [2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 23]. The Cephaleuros on ***P. pyrifolia*** in this study is identified as ***C. parasiticus***.

resolution which is in agreement with that in Rindi et al. 2009 [30]. Since there are only a few ***Cephaleuros*** strains with multilocus sequence data available in the database at present, the relationship of various algae species may need further elucidation. To obtain molecular characteristics form various genetic barcode regions would benefit the multilocus sequence analysis of ***Cephaleuros*** in the future.

The plant parasitic algae ***Cephaleuros*** has been recorded on many host plants in the tropics and subtropics, with 241 hosts belonging to 68 plant families across Taiwan (Table 1). In contrast, ***Cephaleuros*** was known to infect 129 species in 44 families and 165 species in 53 families in Thailand and Florida, respectively [18, 26], whereas there were 448 hosts listed in a state in Brazil [17, 26]. It is evident that the algae in this genus is widespread in tropical and subtropical regions. In our review of Taiwan records, all of the recorded hosts are vascular plants, including Angiosperms, Gymnosperms, and ferns (Table 1), which is in line with the observations in Florida [26]. Most of the hosts of ***Cephaleuros*** in Taiwan are forest trees and some are economically important plants, e.g. tea, Mandarin orange, longan, persimmon, loquat, lychee, mango, guava, Asian pear, and wax apple, etc. In many cases, the algal spots on the leaves were sparse and they seemed harmless to the crops, but we observed some infections on young twigs, inhibiting the growth of the fruit trees in the orange and persimmon orchards. The impacts of the algal spot diseases on the plants need further investigations.

Prior to this study, only ***C. virescens*** has been reported in Taiwan. As in Suto [34], not all the algae recorded as ***C. virescens*** are confirmed. Moreover, a plant could serve as the host of several ***Cephaleuro*** species [18, 32]. To our knowledge, this is the first report of ***C. parasiticus*** on ***P. pyrifolia*** in Taiwan. It is suggested that the diversity of ***Cephaleuros*** in the tropics and subtropics may be underestimated. More species, such as ***C. parasiticus*** recorded in this study, may be recognized in future by detailed phenotypic and molecular studies.

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## 摘　要

沈原民、蕭卉妤、黃冬青。2022。臺灣頭孢藻回顧及新記錄由*Cephaleuros parasiticus*感染梨樹。植物醫學64(2): 35-52。

本研究取得造成植物藻斑病的頭孢藻屬(*Cephaleuros*)絲狀藻類形態與分子特徵，近期在臺灣的亞洲梨(*Pyrus pyrifolia*)上採到的樣本鑑定為*C. parasiticus*。比較18S rDNA、ITS、rbcL條碼序列，梨上的頭孢藻序列與臨近愛玉上的頭孢藻樣本幾近相同，分析具良好親緣關係解析度的rbcL片段，所取得的序列與美國的*C. parasiticus*序列形成單系群。本研究首次在臺灣記錄*C. parasiticus*在*P. pyrifolia*上。回顧藻斑病在臺灣的文獻，島內的頭孢藻曾被發現在68個植物科內241種植物上，最常被記錄在樟科，其次分別是茶科、殼斗科植物上，頭孢藻的寄主大多數是森林樹木，而部分為經濟作物。雖然過去僅有*C. virescens*曾記錄在臺灣，本研究指出頭孢藻在此區域應有更高的多樣性。

關鍵詞：頭孢藻、寄生性藻類、藻斑病、菫青藻科、森林生物多樣性、特用作物