



## THE LICHEN GENUS *LEPRARIA* ACH. (STEREOCAULACEAE, LICHENIZED ASCOMYCOTA) IN ROMANIA

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**Key words:** lichenized fungi, *Lepraria*, key, biodiversity.

**Introduction.** The genus *Lepraria* includes diffuse or indefinitely delimited species, always sterile, Lendemer (1) naming it „the most unusual member of the sterile lichen crusts”. According to Tonsberg (2), the leprarioid state appeared as an adaptation to a substrate characterized by dry surfaces, in sites with high humidity and low illumination. The thallus is leprose with an entirely sorediate surface. The lack of fruiting bodies has made the lichens from this group among the least known and studied for a long time. The increase in the number of studies on sterile crustose lichens in recent period has led to an increase in the number of accepted species of the genus *Lepraria*. The information on the genus *Lepraria* is not uniformly distributed, the current checklist describes only two species, *L. caesioalba* and *L. finkii* in Romania. The recent appearance of several studies that indicate the presence in Romania of other species of the genus mentioned, created the motivation of this study.

**Material and methods.** This study is based on material from the Babes-Bolyai University (CL) herbaria in Cluj-Napoca, Romania and literature data. For 13 species, specimens have been examined.

**Results.** The key for the species of genus *Lepraria* is proposed, adapted from Wirth (3). The species distribution maps in Romania are given.

**Conclusions.** Fifteen Romanian species are revised, *Lepraria eburnea*, *L. ecorticata*, *L. umbricola* were reported from two locations, *L. neglecta* was found only in one location. Most widely distributed species in Romania seems to be *L. finkii* and *L. membranacea*.

**Cuvinte cheie:** ciuperci lichenizate, *Lepraria*, cheie de determinare, biodiversitate.

### GENUL DE LICHENI *LEPRARIA* ACH. (STEREOCAULACEAE, ASCOMICETE LICHENIZATE) ÎN ROMÂNIA

**Introducere.** Genul *Lepraria* include specii cu tal difuz sau delimitat nedefinit, întotdeauna sterile, Lendemer (1) numindu-l „cel mai neobișnuit membru al lichenilor crustoși sterili”. După Tonsberg (2), starea leprarioidă a apărut ca o adaptare la un substrat caracterizat prin suprafețe uscate, în stațiuni cu umiditate ridicată și iluminare redusă. Talul este lepros cu o suprafață în întregime sorediată. Lipsa corpurilor de fructificație a făcut ca, pentru multă vreme, lichenii din acest grup să fie printre cei mai puțin cunoscuți și studiați. Creșterea numărului de studii asupra lichenilor crustoși sterili în ultima perioadă, a dus la creșterea numărului de specii din genul *Lepraria* acceptate. Informațiile despre genul *Lepraria* nu sunt distribuite uniform, lista actuală descrie doar două specii, *L. caesioalba* și *L. finkii* în România. Apariția recentă a mai multor studii care menționează prezența în România a altor specii din genul menționat, a creat motivația acestui studiu.

**Material și metode.** Acest studiu se bazează pe materialul lichenic din Herbarul Universității Babeș-Bolyai (CL Herbarium) din Cluj-Napoca, România și datele din literatura de specialitate. Pentru 13 specii, au fost examinate eșantioane.

**Rezultate.** Cheia pe care o propunem este adaptată după Wirth (3). Deasemenea, sunt date hărțile de distribuție a speciilor în România.

**Concluzii.** Cincisprezece specii din România sunt revizuite, *Lepraria eburnea*, *L. ecorticata*, *L. umbricola* au fost raportate din două locații, *L. neglecta* a fost găsită doar într-o singură locație. Cele mai răspândite specii din România se consideră a fi *L. finkii* și *L. membranacea*.

## INTRODUCTION

The genus *Lepraria* includes diffuse or indefinitely delimited species, always sterile, Lendemer (1) naming it “the most unusual member of the sterile lichen crusts”. The thallus is leprose with an entirely sorediate surface (4). Molecular studies indicates gender affiliation to Stereocaulaceae family (4). The lack of fruiting bodies makes lichens in this group among the least known and studied (1). The leprarioid state appeared as an adaptation to a substrate characterized by dry surfaces, in sites with high humidity and low illumination (2). However, since 2000 there was an increase in the number of studies on sterile crustose lichens (5), which also increased the number of taxa of the genus *Lepraria* accepted. Thus, Lendemer (1) documents the existence of 57 species and 2 varieties worldwide. The information on the genus *Lepraria* is not uniformly distributed, Ciurchea’s checklist (6) describes only two species of the genus *Lepraria* in Romania, respectively *L. caesioalba* and *L. finkii*. The recent appearance in Romania of several doctoral thesis (7, 8, 9) and scientific articles that mention the presence of other species of the genus mentioned above, create the motivation of this study. We established a list of 15 species, for which we made a key attempt.

In Romania, *Lepraria* taxa stands in beech forests, coniferous and mixed forest, dwarf mountain pine shrubs and alpine meadows. Species of *Lepraria* can inhabit bark, wood, soil or rock, and frequently in sheltered sites where they are protected from direct sunlight.

## MATERIAL AND METHODS

This study is based on material from the Babes-Bolyai University (CL) herbaria in Cluj-Napoca, Romania and literature data. For 13 species, specimens have been examined by specialists from: *Lepraria caesioalba* – Department of Botany, Institute of Botany, Academy of Sciences Pruhonice (10), *Lepraria lobificans* – Herbarium Université de Liège (LGHF) and Swiss Federal Research Institute WSL (11); *L. nivalis* – Herbarium Hungarian Natural History Museum (BP) and Swiss Federal Research Institute WSL (11); *L. jackii*, *L. rigidula*, *L. vouauxii* – Department of Botany, Institute of Botany, Academy of Sciences Pruhonice (10), Swiss Federal Research Institute WSL (11); *Lepraria eburnea*, *L. ecorticata*, *L. elobata*, *L. membranacea*, *L. negelecta*, *L. toensbergiana*, *L. umbriicola* – Swiss Federal Research Institute WSL (11). The key we propose is adapted from Wirth (3). The species distribution maps in Romania are given.

## RESULTS

### *Lepraria* species distribution in Romania

#### 1. *Lepraria caesioalba* (de Lesd.) J.R. Laundon var. *caesioalba* (fig. 1)

Lichenologist 24: 324 (1992); *Crocynia caesioalba* de Lesd., Bull. Soc. Bot. France 61: 84 (1914); *Leproloma caesioalba* (de Lesd.) M. Choisy, Bull. mens. Soc. linn. Lyon II 19: 12 (1950) *Crocynia henrici* de Lesd., Bull. Soc. Bot. France 61: 84 (1914).

Alba County: Detunata Mt. (12).

Arges County: Iezer-Papusa Mts., Riusorul to Zanoaga Mt. (9).

Brasov County: Tampa Mt. (12).

Hunedoara County: Retezat Mts., alpine zone around the lake Bucura (10).

#### 2. *L. eburnea* J.R. Laundon (fig. 2)

Lichenologist 24: 331 (1992); *Lepraria frigida* J.R. Laundon, The Lichenologist 24: 332 (1992).

Maramures County: Rodnei Mts., Borsa (CL) 664515; Rodnei Mts., Repedea Valley (CL) 664494, 664518.

#### 3. *L. ecorticata* (J.R. Laundon) Kukwa (fig. 3)

Mycotaxon 97: 64 (2006); type: United Kingdom, England, Devon, Ilfracombe, Torrs Walks, 1. Sept. 1971, J. R. Laundon 2851 (BM—holotypus). *Lecanora ecorticata* J.R. Laundon, Nova Hedwigia 76: 100 (2003).

Maramures County: Rodnei Mts., Pietrosul Mare Nature Reserve (CL) 664498; Rodnei Mts., Repedea Valley (11).

#### 4. *L. elobata* Tonsberg (fig. 4)

Sommerfeltia 14: 197 (1992)

Maramures County: Rodnei Mts., Cascada Cailor (CL) 664508; Rodnei Mts., Izvorul lui Dragos Valley, Pietrosul Mare Nature Reserve, Repedea Valley (11).



Figure 1. Distribution of *Lepraria caesiocalba* var. *caesiocalba* in Romania.



Figure 2. Distribution of *Lepraria eburnea* in Romania.



Figure 3. Distribution of *Lepraria ecorticata* in Romania.



Figure 4. Distribution of *Lepraria elobata* in Romania.

**5. *L. finkii*** (Hue) R.C. Harris (1985) (fig. 5)

*Crocynia finkii* B. de Lesd., in Hue, *Bull. Soc. bot. Fr.* 71: 334 (1924); *Crocynia aliciae* Hue, *Bull. Soc. bot. Fr.* 71: 333 (1924); *Crocynia americana* de Lesd., *Bull. Soc. bot. Fr.* 71: 333 (1924).

Arges County: Iezer-Papusa Mts., Riusorul to Zanoaga Mt. (9).

Bacau County: Casin River Basin, Casin Monastery, Halos Ciubotaru Forest (13).

Bihor County: Bihorului Mts., Rachita Peak (14).

Bistrita-Nasaud County: Rodnei Mts., the upper basin of the Rebra Valley (15); forests near Arcalia Scientific Resort (16); Nasaudului Hills, Satului Valley (17).

Botosani County: Dorohoi surroundings (18).

Cluj County: Gilau-Muntele Mare Mts., Huza Valley (17); Iara Valley (15); Vladeasa Mts., Racad Valley (15); Nonei Valley (19).

Harghita County: Bicazului Gorge (20).

Hunedoara County: Retezat National Park (22), Zlatuia Valley (21).

Ilfov County: Bucharest, Mogosoaia Forest (12).

Maramures County: Barjaba (19).

Prahova County: Ciucas Mts. (23).

Suceava County: Calimani Mts., Dragalele Valley (12); Rarau Mts., Pietrele Doamnei (12); Codrul Secular Slatioara (12).

**6. *L. incana*** (L.) Ach. (fig. 6)

Meth. Lich.: 4 (1803); type: United Kingdom, drawing in Dillenius, *Hist. Musc.*: tab. I fig. 3 (1742) (holotypus); typotypus: herb *Hist. Musc.*: tab. I no 3 (OXF). *Byssus incana* L., *Sp. Pl.* 2: 1169 (1753).

Alba County: Trascau Mt., Detunata (24); Aiud Bichis, Raristi, Lopadea, Valisoara Forest (25).

Arad County: Zarandului Mts., Slatina de Mures, Barzava, Milova (26).

Cluj County: Vladeasa Mts., Poienita, Capra, (24); Gilau Mt., Baisoara (24); Marisel, Feleac (27).

Maramures County: Barjaba (24).

Suceava County: Rotunda Pass (11).



Figure 5. Distribution of *Lepraria finkii* in Romania.



Figure 6. Distribution of *Lepraria incana* in Romania.

### 7. *L. jackii* Tonsberg (fig. 7)

*Sommerfeltia* 14: 200 (1992); type: Norway (BG – holotype; BM – isotype); *Lepraria toensbergiana* Slav.-Bay & Kukwa, *Bryologist* 108: 132 (2005).

Hunedoara County: Retezat Mts., camping site Pietrele (10).

Maramures County: Rodnei Mts., Cascada Cailor (CL) 664492, 664501; Rodnei Mts., Repedea Valley, Pietrosul Mare Nature Reserve, Borsa (11).

### 8. *L. lobificans* Nyl. (fig. 8)

*Flora* 56: 196 (1873); type: France (H – lectotype; BM – topotype).

Bihor County: Padurea Craiului Mts., Sighiles Valley (1996), between Calatele and Varciorog, (CL) 655943.

Maramures County: Rodnei Mts., Repedea Valley (CL) 664511; Rodnei Mts., Pietrosul Mare Nature Reserve, Borsa (11).

Suceava County: Calimani Mts., Driglele (28); Calimani Mts, Calimani National Park, Haitii Peak, valley of the stream Tarnita (BP) 93460 (29).

### 9. *L. membranacea* (Dicks.) Vain. (fig. 9)

*Acta Soc. Fauna Flora Fennica* 49(2): 265 (1921); type: United Kingdom, Scotland, J. Dickson (BM ex K ex D Turner – holotypus). *Lichen membranaceus* Dicks., *Fasc. Pl. Crypt. Brit.* 2: 21 (1790). *Lepriloma membranaceum* (Dicks.) Vain., *Term. Füz.* 22: 293 (1899).

Alba County: near Campeni, Detunata Mt. (12).

Brasov County: Racatau Valley, Racota Valley, Persani Mts., Dopcei Cave, Bogatii Cave (12).

Cluj County: near Turda (12), Fantanele Dam, Somesului Cald Valley, between Fantanele Dam and Tarnita (30), Vladeasa Mts., Nonei valley, Preluca Rabului (19).

Dambovita County: Bucegi Mts., Zanoagei Gorge (12), Leaota Mts., Cheii Valley (31).

Harghita County: Harghita Mts., Sfanta Ana Lake (12).

Hunedoara County: Retezat Mts., Raul Mare Valley (12), Rausor Valley, Stanisoara Valley, Valeriasca Valley, (12), Retezat National Park, Gemenea Lake, Taul Negru, Zlatuia Valley (21); Cetatea de Boli, near Petrosani, Sureanului Mts., Auselul Mt. (12).

Maramures County: Rodnei Mts., Repedea Valley (11).

Prahova County: Busteni, Urlatoarea Mare, Ialomitei Valley, Sinaia (12).

Sibiu County: Fagaras Mts., Arpas Mt., Cartisoara Mt., (12).

Suceava County: Codrul Secular Slatioara (12).

Valcea County: Lotrului Mts., Calinesti Valley (32), Defileul Cozia (Oltului Valley between Proeni and Calinesti) (33).





Figure 7. Distribution of *Lepraria jackii* in Romania.



Figure 8. Distribution of *Lepraria lobificans* in Romania.

**10. *L. neglecta*** (Nyl.) Erichsen (fig. 10)

Erichsen, in Lettau, Feddes Repert. 61: 127 (1958); *Lecidea neglecta* Nyl., Not. Skällsk. Fauna Fl. Fenn. Förh. 4: 233 (1859).

Maramures County: Rodnei Mts., Pietrosul Mare Nature Reserve (CL) 664498.



Figure 9. Distribution of *Lepraria membrancea* in Romania.



Figure 10. Distribution of *Lepraria neglecta* in Romania.

**11. *L. nivalis*** J.R. Laundon (fig. 11)

Lichenologist 24: 327 (1992); *Crocynia murorum* de Lesd., Bull. Soc. Bot. France 95:199 (1948).

Maramures County: Rodnei Mts., Pietrosul Mare Nature Reserve (CL) 664482; Rodnei Mts., Borsa, Repedea Valley, Batrana (11).

Bihor County: Bihor Mts., Zgurasti Cave System (Avenul Zgurasti), 1,5 km NE of Garda de Sus village, between V. Garda Saca and V. Ordancusa (CL) 658547, 658546.

**12. *L. rigidula*** (de Lesd.) Tonsberg (fig. 12)

Sommerfeltia 14: 205 (1992); type: United Kingdom, Scotland, Perth, Pitlachry, byside of R. Tummel, Jun. 1914, J. McAndrew (E – holotypus). *Crocynia rigidula* de Lesd., in Hue, Bull. Soc. Bot. France 71: 331 (1924).

Hunedoara County: Retezat Mts., alpine zone around the lake Bucura (10).

Maramures County: Rodnei Mts., Cascada Cailor (CL) 664502; Rodnei Mts., Repedea Valley, Borsa (11).

**13. *L. toensbergiana*** Bayerova & Kukwa (fig. 13)

Bryologist 108(1): 132 (2005); type: Poland, Western Carpathians, Eastern Tatra Mts, Dolina Roztoki Valley, near Nowa Roztoka, 21. Aug. 1999, W. Fałtynowicz, s.n. (UGDA – holotypus; herb. S. Bayerová – isotypus).

Maramures County: Rodnei Mts., Repedea Valley (CL) 664517; Rodnei Mts., Pietrosul Mare Nature Reserve, Izvorul lui Dragos Valley (11).



Figure 11. Distribution of *Lepraria nivalis* in Romania.



Figure 12. Distribution of *Lepraria rigidula* in Romania.

**14. *L. umbricola*** Tonsberg (fig. 14)

Sommerfeltia 14: 206 (1992); type: Norway, Hordaland, Bergen, Milde, Brandaneset, 25. Sept. 1990, T. Tonsberg 13635 (BG – holotypus).

Maramures County: Rodnei Mts., Izvorul lui Dragos Valley (CL) 664496; Rodnei Mts., Repedea Valley (11).

**15. *L. vouauxii*** (Hue) R.C. Harris (fig. 15)

Harris, in Egan, The Bryologist 90: 163 (1987); *Crocynia vouauxii* Hue, Bull. Soc. Bot. France 71: 392 (1924); *Lepriloma vouauxii* (Hue) J.R. Laundon, The Lichenologist 21: 13 (1989) *Crocynia arctica* Lynge, Skr. om Svalbard og Ishavet 81: 19 (1940); *Lepraria arctica* (Lynge) Wetmore, Publs Mich. St. Univ. Mus., biol. ser., 3: 440 (1968).

Hunedoara County: Campu lui Neag, Cheile Butii, in the gorge Cheile Scorota (10).

Maramures County: Rodnei Mts., Borsa (CL) 664495; Repedea Valley (11).



Figure 13. Distribution of *Lepraria toensbergiana* in Romania.



Figure 14. Distribution of *Lepraria umbricola* in Romania.



Figure 15. Distribution of *Lepraria vouauxii* in Romania.

### Key to the species of *Lepraria* in Romania

- 1 Thallus sharply bordered at the margin, coherent, in the case of well-developed rounded rosettes, appearing lobed or with radial folds .....2
- 1\* Thallus not rounded rosetted and lobed or with radial folds .....9
- 2 On limestone, soil, mosses.....3
- 2\* On silicate rock, acidophytic mosses, soil, very rarely on bark.....4
- 3 Thallus whitish, cream colored, gray-white, pale greenish, folded skin-like, often regularly rounded, often with radially aligned cracks, almost somewhat lobed, in the center often breaking up.....***L. nivalis***
- 3\* Thallus greenish white, blue-greenish white, thick, coherent, sometimes producing a lobed thallus, at times loosening itself and easily breaking away..... ***L. lobificans***
- 4 Thallus sharply delimited, at least at the margin pale yellowish, spongy-pliant, of thick coalescing soredia-like, cottony to rather compact granules, with age often undifferentiated leprose. Pannaric acid, roccellic acid ..... ***L. membranacea***
- 4\* Thallus relatively unclearly margined, not yellowish at the margin, not spongy-pliant, on rain exposed habitats on mosses, rarely directly on silicate rock, of relatively compact granules, without pannaric acid .....5
- 5 Atranorin and fumarprotocetraric acid or stictic acid complex. .... ***L. caesioalba* var. *caesioalba***
- 5\* Atranorin, alectorialic or angardianic acid.....6
- 6 Thallus of coarsely granular, non-powdery soredia containing alectorialic acid .....***L. neglecta***
- 6\* Thallus of fine, powdery soredia or with long projecting hyphae, not coarsely granular, containing atranorin acid, rangiformic and angardianic acids always absent, other fatty acids present .....7
- 7 Thallus of soredia with long projecting hyphae, containing atranorin, nephrosteranic acid .....***L. rigidula***
- 7\* Thallus of finer soredia without any or only with short projecting hyphae, containing atranorin and fatty acids other than nephrosteranic acid .....8
- 8 Thallus containing atranorin, jackinic acid, and roccellic acid; from lowlands to montane belt .....***L. jackii***
- 8\* Thallus containing atranorin and toensbergianic acid; montane, rare at low elevations .....***L. toensbergiana***
- 9 Thallus white.....10
- 9\* Thallus greenish.....11
- 10 Thallus white to light grey, often creamy or slightly greenish, with alectorialic acid, KC+ fleeting! Reddish (observe under the binocular, „scrape” the thallus with a preparation needle)..... ***L. eburnea***
- 10\* Thallus whitish-cream colored, often slightly yellowish, without Alectorialic acid, not KC+ reddish. With Pannaric acid-6-methylester, ..... ***L. vouauxii***
- 11 Thallus leprose.....***L. elobata***
- 11\* Thallus crustose.....12
- 12 With divaricatic acid.....***L. incana***
- 12\* Without divaricatic acid.....13
- 13 Soredia well separated from each-other .....***L. ecorticata***
- 13\* Soredia often aggregating .....14
- 14 Soredia aggregating in large clusters (up to 200 µm), usually with long projecting hyphae, up to 0,1 mm long..... ***L. finkii***
- 14\* Soredia up to 60 µm, relatively densely packed, projecting hyphae rarely present.....***L. umbricola***

### DISCUSSION

*Lepraria caesioalba* var. *caesioalba* was found in Romania on mosses growing on smooth bark (*Betula*, *Alnus*) and on rocks. It belongs to the *L. neglecta* group, being differentiated by the fact that it rarely develops directly on rocks (2).

Distribution: Europe, North and South America, Asia, Australasia, Antarctica, Greenland (5).

*Lepraria eburnea* was found in Romania on dead wood and spruce bark, usually it grows on stone, rarely on bark (34). Specimens of *L. eburnea* may

be morphologically similar to *L. finkii*, but differ chemically (30). Distribution: in Europe, North America, Asia and Australia (34).

*Lepraria ecorticata* was found in Romania in *Pinus mugo* shrubs, on bark of *P. mugo*; Kukwa (34) indicates that it prefers rocks. Rare species, reported from Europe, Asia, South America (34).

*Lepraria elobata* in Romania was identified on dead wood, generally it is found on soil, siliceous rocks and mosses (5). Chemical similarity with *L. lobificans*, which differs morphologically by thallus lobate (2) and cottony appearance (5). Similar chemistry with *L. finkii* which has a wooly, thick thallus (34). Distribution: Europe, North America, Greenland (5).

*Lepraria finkii* is in Romania a corticolous species, found in coniferous and broadleaf or mixed forests. Similar chemistry with *L. elobata*, species from which it differs morphologically by its wooly, thick thallus (34). Distribution: in all continents, except Antarctica (34).

*Lepraria incana* is also corticolous in Romania, found in orchards and mixed forests. A species variable morphologically, sometimes similar to *L. elobata*, which differs chemically, lacking divaricatic acid (5). Distribution: all continents, except Antarctica, Arctic regions and North America (34).

*Lepraria jackii* was found in Romania on spruce bark; it shows in our country similar ecology with specimens growing in Belarus and Poland (34). Distribution: Europe, North America, Asia, Australia (5).

*Lepraria lobificans* grows in Romania on beech and spruce bark, also on acid soil. For chemically similar species see the discussion under *L. elobata*. Distributed worldwide (5).

## CONCLUSIONS

1. Fifteen species are included in this study, *Lepraria eburnea*, *L. ecorticata*, *L. umbricola* were reported from two locations, *L. neglecta* was found only in one location. Although they do not appear on the Red Lists in Romania or surrounding countries, these species may be endangered in Romania.
2. Most widely distributed species in Romania seems to be *L. finkii* and *L. membranacea*.
3. We subscribe to the statement of Bungartz (37), that identification keys for these lichens typically rely more on chemical characters, morphological characters being considered somewhat problematic.

## CONFLICT OF INTERESTS

*Lepraria membranacea* was found in Romania on beech and spruce bark. Might be confused with *L. vouauxii* which has pannaric acid 6-methylester (4). Distributed worldwide.

*Lepraria neglecta* was found in Romania on the soil of alpine pastures. *L. eburnea* has similar chemistry with *L. neglecta*, but has different morphology – thallus granular and coarse – and ecology, living in exposed places to sun and rain (34). Distribution: Europe, North and South America, Australasia, Antarctica, Greenland (5).

*Lepraria nivalis* was identified on soil and on limestone; in Europe is common in Mediterranean areas and south of the continent (5). It was found also in North America, Australasia, Antarctica, Greenland (5).

*Lepraria rigidula* in Romania was identified on beech bark. Some specimens could have a greenish colour resembling *L. jackii* (34), which has a different chemistry – atranorin, zeorin and fatty acids (5). Distribution: Europe, North America, Asia, North of Africa (35).

*Lepraria toensbergiana* was found in Romania on deadwood. Close in morphology to *L. jackii* (which contains jackinic acid), chemically similar to *L. rigidula*, whose soredia have long hyphal projections. Also, distribution differs from *L. jackii* and *L. rigidula*, *L. toensbergiana* being common in mountain areas (36).

*Lepraria umbricola* was found in Romania on deadwood. May be found on bark, rock, mosses and soil, especially on acidic substrate. Similar to green coloured *L. ecorticata*, differs by producing thamnolic acid (5). Distribution: Europe, Macaronesia (35).

*Lepraria vouauxii* in Romania was discovered on deadwood. Occurring worldwide in natural and urban habitats (34).

There are no conflicts of interest to be mentioned.





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