Boletín Micológico Vol. 3 Nº 3 - 201-207 - 1987

NOTES ABOUT CHILEAN UREDINALES. VI: UROMYCES TRAUCOENSIS SP. NOV. ON SELLIERA RADICANS CAV. (GOODENIACEAE) AND ITS DISTRIBUTION AREA.

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SUMMARY

*The characteristics of a new autoic and macrocyclic rust (***Uromyces traucoensis** *n. sp.) occurring on* **Selliera radicans** *Cav. (Goodeniacea) in Chile are described. This rust is very similar to* **U. sellieriae** *and* **U. scaevolae**, *the former from New Zealand and the latter from New Zealand, Australia and Tasmaria on the same host. The dispersion of* **Selliera** *and the three* **Uromyces** *species is comprared with that of Uredinales attacking Coniferae, of* **Cyttraria** *on* **Nothofagus**, *and of* **Uromyces minor** *on* **Trifolium dubium** *both in Chile and New Zealand.*

RESUMEN

[Notas sobre Uredinales chilenas. VI: Uromyces traucoensis sp. nov. en Selliera radicans Cav. (Goodeniaceae) y sus áreas de distribución]

Se describen las características de una nueva especie de Uredinal autoico y macrocíclico sobre **Selliera radicans** *Cav. (Goodeniaceae) en Chile, al que se le denominó* **Uromyces traucoensis**, *estableciéndose semejanzas y diferencias con otras especies de* **Uromyces** *que atacan este hospedero en Australia y Nueva Zelandia.*

Se comenta la dispersión del hospedero y de las tres especies de **Uromyces**, *correlacionándola con otros casos semejantes, tales como Uredinales que atacan coníferas, el género* **Cyttaria** *sobre* **Nothofagus** *y el caso de similitud extremadamente coincidente del mismo biotipo de* **Uromyces minor** *sobre* **Trifolium dubium** *en Chile y Nueva Zelandia.*

INTRODUCTION

According to Cronquist (1981) and Melchior (1964), the fam. Goodeniaceae consisting of 14 genera and 30 species mostly of Australian origin, is also found in New Zealand, Japan and in different tropical and subtropical regions, both in the new and old world. **Selliera radicans** Cav. belongs to this family and is reported from Australia, New Zealand and Chile. Information from the herbarium of the University of Concepción, indicates that in Chile this species occurs in saline and swampy coastal lands from Huasco to the Guaitecas Islands (28º 30'-44º 0' S.L.).

The first rust record on this plant was recorded in Australia (Mc Alpine, 1906) and New Zealand (Cunningham, 1913) from where two **Uromyces** species were described: **U. sellieriae** G.H. Cunn. with 0, II and III, exclusively of New Zealand, and **U. scaevolae** G.H. Cunn., widely distributed in eastern and southern Australia, Tasmania, New Zealand with I, II and III.

From Chile no rusts are so far reported occurring on **Selliera** (Mujica and Vergara, 1980). However, a new rust attacking **S. radicans** has been recently collected in Gaubún. (Ancud, Chiloé Island).

METHODS

The first rust material was collected in Gaubún on January 31, 1981 (Table 1), Additional samples were collected from a few other sites from Corral to Quemchi. On May 22, 1982, plants with soil from Gaubún were collected again and cultivated; subsequently microscopic measurements and microphotographies of the different fungal states and mature spores were made (spermogonia = 0, aecidia = I, uredosori = II and teleutosori = III).

Furthermore, histological sections of

1 Research project Nº A 1484-8323 of the University of Chile's Research and Development Department.

spermogonia, aecidia, uredosori and teleutosori were made with a freezing microtome. From these, spores were also obtained for scanning electron microscopic (SEM) studies according to the methodology pointed out by Latgé et al (1982).

TABLE 1

Localities where U. traucoensis was collected

Locality	Province	Date	State
Gaubún	Chiloé	31-I-1981	0-I*
		22-V-1982	I-II-III
Quinterquén	Chiloé	27 y 29 XII-1982	0-I-II-III
Corral	Valdivia	22-II-1983	II y III

* Type material

RESULTS

Symptomatology

The first symptoms are chlorotic spots on both leaf surfaces and rarely on petioles. Subsequently, spermogonia (0) and amphigenous aecidia (I) appear on these spots. the Aecidia are orange-yellow; when they occur in great numbers they converge producing leaf elongation and deformation resulting in necrotic tissue and plant defolation. Later, pulverulent reddish-brown amphigenous uredosori (II) develop. On these, teleutospores (III) grow and chlorosis appears around a central sorus. Several sori may converge producing necrosis and defoliation.

Aetiology

The above mentioned symptoms are caused by an undescribed **Uromyces** whose measurements and characteristics differ (Tables 2,3) from the two earlier described species on **S. radicans** (Mc Alpine, 1960; Cunningham, 1923; 1931). We consider this autoecious and macrocyclic rust a new species, **Uromyces traucoensis**, whose name is derived from the Chilean word "Trauco" (= mythological being).

TABLE 2

Dimensions of aecio (I) (peridial cells = P.C.), uredo (II) and teleutospores (III) of U. traucoensis*

Spores and walls	Dimensions (spore lenght and width, and wall thickness)
I	30.2 (23.4-37.7) x 24.7 (18.4-31.9) um
P.C.	36.7 (24.4-52.5) x 23.0 (15.0-36.0) um
II	36.0 (30.4-46.9) x 32.7 (26.2-39.8) um
Wall	2.6 (1.9-3.7) um
III	35.6 (30.0-43.1) x 28.4 (21.9-36.2) um
Apical wall	5.0 (3.4-7.1) um
Side wall	2.4 (1.5-3.0) um

* 100 measurements

Uromyces traucoensis n.sp. is an autoecious and macrocyclic rust whose main characteristics are as follows:

Uromyces traucoensis n. sp.

Spermogonia amphigena, subepidermata in maculis flavis insidentia, subglobosa, 49.6 (46.1-50.8) x 45.0 (41.5-46.1) u diam. Aecia epiphylla, sistemica, cupulata, flavoaurantiacea; cellulae peridae inaequaliter rhomboideae, 36.7 (24.4-52.5) x 23.0 (15.0-36.0) u; aeciosporae catenulatae, late globosae vel ellipsoideae, episporio hyalino vel pallide brunneoflavo, verrucosae, 30.2 (23.4-37.7) x 24.7 (18.4-31.9) u. Uredinia amphigena, rufo-brunnea, sparsa vel circumcincta, 2-3 mm diam.; urediniosporae globosae vel subglobosae, complanatae, 36.0 (30.4-46.9) x 32.7 (26.2-39.8) u, episporio brunneoflavo, 2.6 (1.9-3.7) u crasso, echinulato circum porum, poris germinativis 2, equatorialibus. Teliosporae per uredinia aggregatae, brunneocastaneae, ovoideae, obovoideae vel subglobosae, 35.6 (30.0-43.1) x 28.4 (21.9-36.2) u, pariete pallide flavobrunnea, levi, 1.5-3.0 u crassa ad latere, 3.4-7.1 u crassa ad apicem; pedicellus hyalinus, brevis, fragilis. Typus J. Montealegre, HFV, 31 Jan. 1981 ad folias **Selliera radicans** Cav. in Gaubún, insula Chiloé (prope Ancud), Chile; isotypi LPS et PUR.

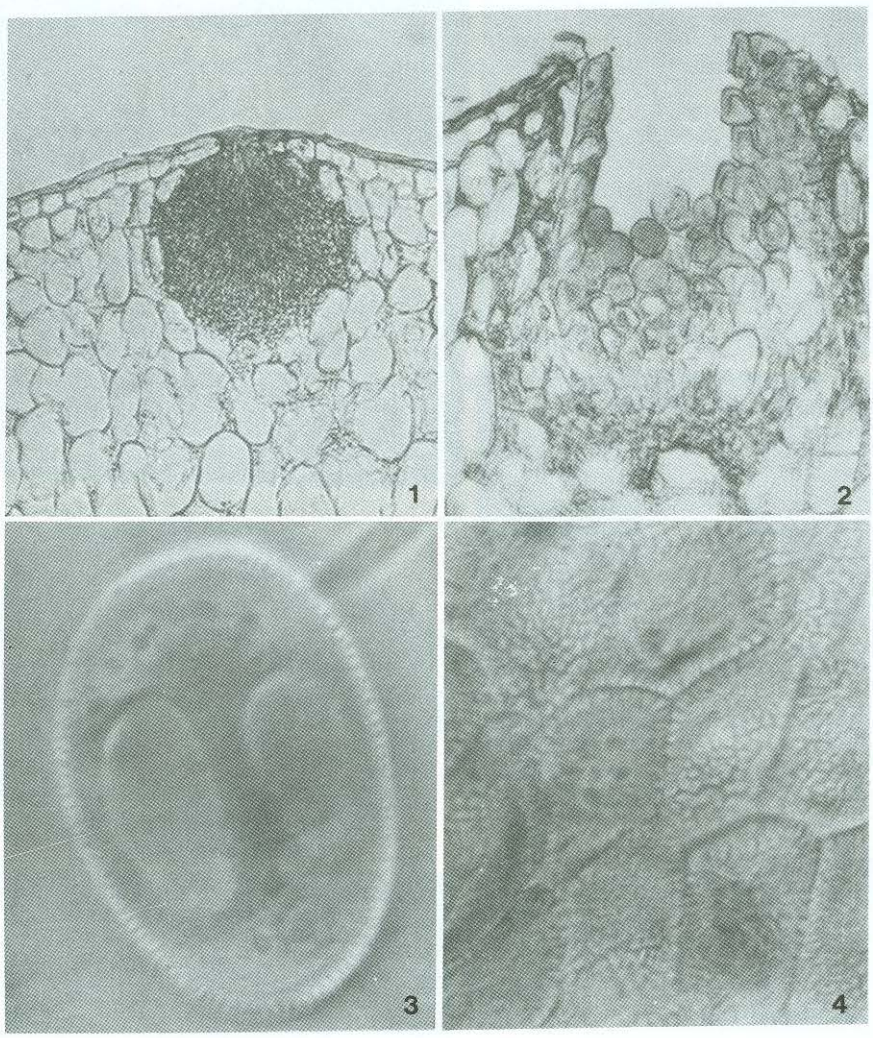

Fig. 1 **Uromyces traucoensis**, spermogonium (570.9 x). Fig. 2. Aecidium and aeciospores (816.1 x). Fig. 3 Aeciospore (7777 x) Fig. 4. Peridial cells (2720 x).

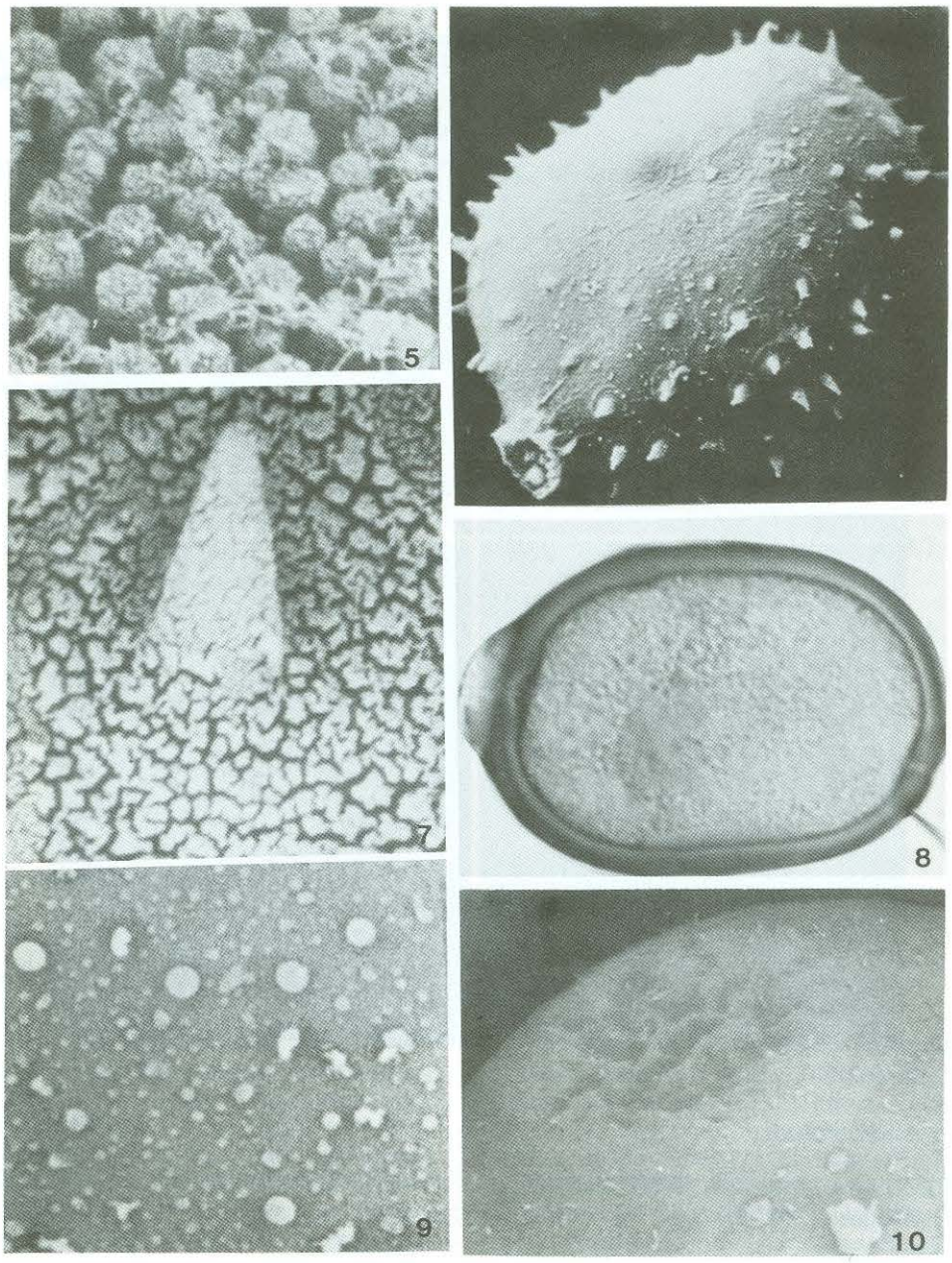

Fig. 5 Aeciospore episporium of U. traucoensis (17777 x). Fig. 6. Uredospore (2333 x). Fig. 7. Uredospores surface and spinule (19000 x). Fig. 8. Teleutospore (4779.4 x). Fig. 9. Teleutospore surface (19.000 x) Fig. 10. Teleutospore apex (44461.5 x).

TABLE 3

Comparative data of three Uromyces species on S. radicans

	U. scaevolae	U. sellieriae	U. traucoensis
Geographical distribution	Australia, Tasmania, N. Zealand	N. Zealand	Chile
States:	0 - I - III	I - II - III	0 - I - II - III
I	14 - 20 x 14 - 18 um (localized)	26 - 36 x 18 - 24 um (localized)	23.4-37.7 x 18.4-31.9 um (systemic)
II	----------	28 - 35 x 30 - 36 um	30.4-46.9 x 26.2-39.8 um
III	32 - 46 x 18 - 24 um	28 - 35 x 18 - 28 um	30.0-43.1 x 21.9-36.2 um
Side wall	----------	----------	2.4 um
Apical wall	15.0 um	----------	5.0 (3.4-7.1) um
Spores III	on I	on II	on II

0 Spermogonia subepidermic, amphigenous and almost spheric 46.1-50.8 x 41.5-46.1 um, average 45.0 x 49.6 um, occurring on yellowish chlorotic spots, apparently without periphysis (Fig. 1).

I Systemic aecidia mostly epiphyllous, disperse, orange-yellow with hyaline borders (Fig. 2). Peridial cells with smooth and thinner walls on the outside face but verrucose and thicker, on the inside face; in general, of rhomboidal shape, 24.4-52.5 x 15.0-36.0 um, average 36.7 x 23.0 u (Fig. 4). Aeciospores globose to broadly ellipsoid with a hyaline to light yellowish-brown verrucose epispore, 23.4-37.7 x 18.4-31.9 u, average 30.2 x 24.7 um (Fig. 3).

II. Uredosori of 2-3 mm, subepidermic, mostly epiphyllous, disperse but frequently concentric to a central sorus, reddish-brown, covered when immature and pulverulent later on. Uredospores globose to subglobose, laterally flattened, 30.4-46.9 x 26.3-39.8 um, average 36.0 x 32.7 um (Fig. 6), with yellowish-brown to light-yellow epispore, 1.9 x 3.7 um thick, average 2.6 um, spinulose, with two equatorial germinative pores.

III. Teleutospores intermixed in the uredosori, ovoid or subglobose, 30.0-43.1 x 21.9-36.2 um, average 35.6 x 28.4 um, chestnut-brown smooth wall with yellowish-brown epispore with a prominent and flattened papilla, 3.4-7.1 um, averge 5.0 um, localized at the apex or laterally, 1.5-3.0, average 2.0 um; hyaline, short and fragile pedicel (Fig. 8).

The following characteristics are based upon SEM observations: aeciospores with epispore covered with small truncated verrucae, densely agglomerated (Fig. 5); uredospores with the spinules disappearing near the germinative pore (Fig. 6); fissures on the epispore surface with dendritic aspect (Fig. 7); spores flattened on both sides of germ pores (Fig. 6) which hinders the simultaneous observation of both overlapping pores.

Through the light microscope, teleutospores appear as smooth structures; however, in SEM observations they exhibit verruculose unevenly distributed proyections (Fig. 9) and small fissures on the depressed apex of the spores (Fig. 10).

DISCUSSION

The differences among the three Uromyces species on S. radicans are indicated in Table 3. There, it is observed that U. **traucoensis** differs from U. **scaevolae** in that the former presents all the stages (0 - I - II and III) while the latter lacks II. U. **sellieriae** lacks 0 according to Cunningham (1931). U. **traucoensis** aecidia are systemic while those of the two other species are localized. Both U. **traucoensis** and U. **scaevolae**, exhibit an apical papilla in their teleutospres, which is larger in the latter species

Aeciospores are larger in U. **traucoensis** than in the other two species; likewise, urodespores are larger in U. **traucoensis** than in U. **sellierae**, both with two equatorial germinative pores

Teleutospores in U. **scaevolae** are longer and narrower than those of U. **sellierae**. Also, U.

traucoensis teleutospores are wider than those of **U. sellierae**, which are of intermediate size. In the three species there are no actual teleutosori, but teleutospores develop in aecia in **U. scaevolae** and in uredosori in **U. sellierae** and **U. traucoensis**.

All these differences indicated us that this Chilean **Uromyces** would be a new species.

Its should be pointed out that work conducted in New Zealand, from Cunningham (1945) to McKenzie (1981), either adding or correcting information on rusts, did not refer to species attacking **Selliera radicans**.

The similarity of phanerogamic flora of Chile with that of New Zealand and Australia has been reported by Godley (1960), van Steenis (1962), Schmithüsen (1968), Darlington (1969), van Steenis (1971) and Dimitri (1972). Some of them point out the **Nothofagus** genus as one of the most classic examples of this similarity. In the southern hemisphere, **Nothofagus** is distributed in the forest regions of the Patagonic Andes of Chile and Argentina, in New Zealand, Tasmania, Australia, New Caledonia and New Guinea. Its dispersion area, except in the two latter islands, is commonly found in association with **Cyttaria** fungi. Van Steen (1971) also indicates a certain similitude in the Agaricales species forming ectotrophic mycorrhizae in **Nothofagus**, distribution area an aspect which has recently been discussed by Horak (1983).

With regard to rusts (Uredinales), similarities have been reported in spermogonia and aecia of **Mikronegeria alba** (on **Austrocedrus chilensis**), **M. fagi** (on **Araucaria araucana**) and **Caeoma peltatum** (on **Phyllocladus trichomanoides** and **Ph. glaucus**), in Chile and New Zealand (Shaw III, 1976 and Hiratsuka and Hiratsuka, 1980). Both **Mikronegeria** species develop their dikariotic state on deciduous **Nothofagus** in the Patagonic Andean forests. The main host for **Caeoma peltatum** is still unknown.

Cronquist (1981) and Carolin (1978) suggested that Campanulaceae developed mainly in western Gondwana (Southamerica and Africa) Goodeniaceae in Eastern Gondwana (Australasia and Antarctica). Shuster (1976) pointed out that the genus **Nothofagus** would have evolved in Southamerica and would have moved during the Cretaceous period through the Antarctic bridge westward in relation with the areas where it is presently found. Probably, **Selliera radicans** has moved in a similar way but in the opposite direction in more recent times. This conclusion is based on the fact that this species occurs in very distant areas and has not reached a differentiation in subregional species of Australia, New Zealand and Chile. However, **Uromyces** species that today grow on this host over its wide distributional area, are the result of evolution of one primary common ancestral species. This species has evolved till the level fo the three regional species that we mention in this paper.

The identification of this new species of **Uromyces** on **S. radicans**, with characteristics similar to those of the Australian and New Zealand species, leads us to make a comment of difficult acceptability which is the equality shown by another species of the same **Uromyces** genus. In November 1966, the occcurrence of **Uromyces minor** Schroet. on **Trifolium dubium** Sibth. was recorded for the first time in Valdiva (Oehrens and González, 1972). This same association had already been reported in New Zealand by Laundon (1970). So, the adventiceous host, the parasite, and the year of the first observation coincide in both regions. This notable coincidence was further stressed by the identification of this same **Uromyces** genus on pea (**Pisum sativum** L.) in Valdivia (Oehrens and González) at the beginning of 1973. As in the previous case, the infection of this unusual host had also been reported earlier (1971) in New Zealand (Savile, 1979).

Lastly, in addition to the coincidences already pointed out, we would have to add that the **Uromyces minor** biotype is likely to be the same as that of New Zealand, a hypothesis that should be tested by further studies. Likewise, the causes of these coincidences should also be determined by future investigation.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the assistance provided by Prof. Victor Monasterio of Departamento de Biología, Facultad de Ciencias, Universidad de Chile, in the SEM observations, Prof. Clodomiro Marticorena of the Departamento de Botánica, Universidad de Concepción and Prof. Ana María Espinoza, Depto. de Producción Agrícola, Facultad de Ciencias Agrarias y Forestales, Universidad de Chile, for rendering this paper into English.

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