

Use of the temperate lichen *Hypogymnia physodes* (Parmeliaceae) to evaluate air pollution in the Tropics

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Resumen: El líquen *Hypogymnia physodes* se usa en Europa como especie patrón para evaluar la contaminación atmosférica. Su transplante experimental de Reutlingen (Alemania Federal) a San José (Costa Rica), mostró que sobrevive al menos de tres y medio a diez meses y que reacciona al medio tropical adquiriendo las características de coloración de las especies nativas.

It is well known that some organisms, such as lichens and mosses, are particularly sensible to atmospheric pollution. Their use as "bioindicators" is complementary to direct analytical methods, since they provide cumulative records over a particular period of time, are sensitive to many pollutants and can be studied with simple equipment (Winkler 1977).

The response of lichens to air pollution depends on a wide array of factors, including the identity of the species (Hurka and Winkler 1973, Trass 1973), and there have been some efforts to establish a standard reference.

The species *Hypogymnia physodes* was chosen for European use and has been studied in some detail (Trass 1973), which makes it an excellent candidate for use in other regions whenever geographic comparisons are important. Nevertheless, its introduction to tropical environments had never been attempted, and this is a first report of transplantation to the tropical city of San José, Costa Rica.

Ten samples (Fig. 1) from the area outside Reutlingen, West Germany, were enveloped in tissue paper and transplanted two days later to trunks of *Tabebuia rosea* (Bertol.) DC. (Bignoniaceae) on the campus of the Universidad de Costa Rica (second week of March, 1987; 1200 m.s.m. Premontane Moist Forest in the Holdridge system, annual means 20.5 C, 1900 mm precipitation, relative humidity 60%). Two sites were used, one (I, Fig. 1) in a green area about 50 m West of a street, and another (II, Fig. 1) 2 m West of the same street, in a curve where drivers accelerate and where a higher pollution was expected. The transplants were sprayed with water twice a week, around 8 am, until the onset of the rainy season at the end of May.

There were no noticeable differences between the two locations. [In both, the lichens showed a normal appearance until June (Fig. 2A). We ignore if water-spraying acted as a cleaning agent that obliterated the effects of differential contamination. By the first week of that month, three transplants had died, as indicated by large white areas. The rest

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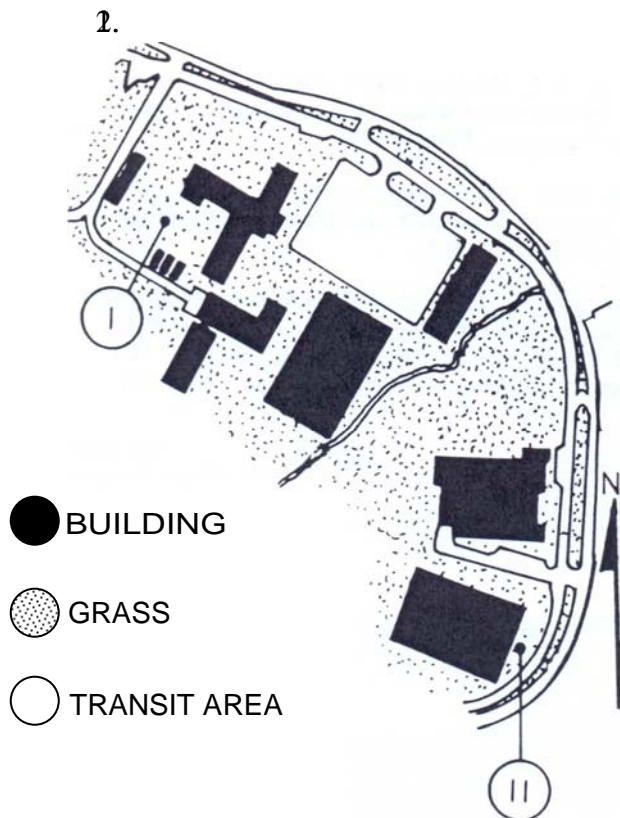


Fig. 1. Transplants of *Hypogymnia physodes*. Four transplants were made in Area 1, in the western side of two trees (two each) and two, one and three, respectively, in the eastern side of three trees in Area II.

developed a pattern of small white spots similar to that of the surrounding native species (Fig. 2B). This is important because it suggests that native lichens can also be used as visual indicators of pollution. August was marked by heavy rainfall, and the transplants died, leaving a naked, dead bark base by the first week of September. Nevertheless, ten months later one transplant still survived in area II (Fig. 2e).

These *H. physodes* survived for 3.5-10 months, despite the fact that for logistical reasons they were transplanted from the end of the European winter to the end of the Neotropical dry season. Transplantation during more favorable conditions could increase their survival time. In conclusion, the use of this species for comparative studies throughout different latitudes has at least three advantages:

1. Results can be more properly compared when the bioindicator is the same in different geographic areas.

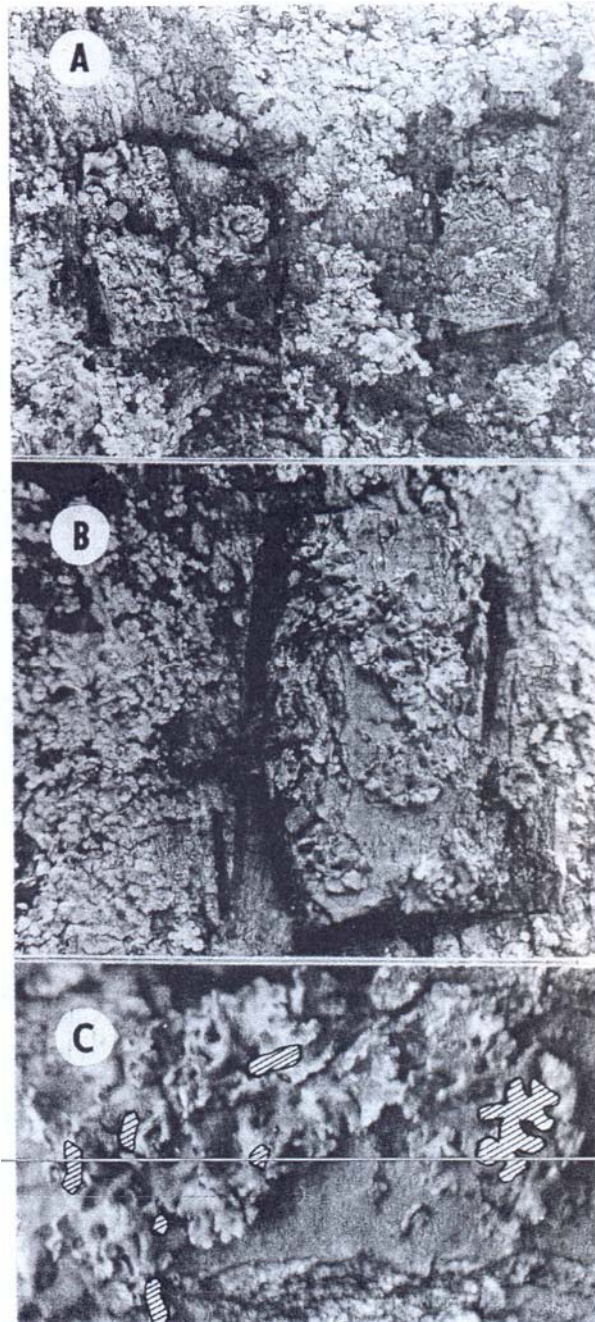


Fig. 2. A: fresh transplants do not show large white patches of decolorophylization. B: The appearance of a transplant that survived at least ten months is similar to that of the surrounding native species (detail in C, patches of decolorophylization hatched).

2. *H. physodes* can be studied even with the equipment available in developing nations, if qualitative results are satisfactory, as is often the case.

3. The minimum survival time obtained here (3.5 months) is prolonged enough for some basic air pollution studies.

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