STUDIA GEOBOTANICA
8: 65-71, 1988

COLONIZATION OF MOSAICS BY LICHENS: THE CASE STUDY OF ITALICA (SPAIN)

J. GARCIA-ROWE and C. SAIZ-JIMENEZ

Keywords: Lichens, Mosaics, Spain.

Abstract: A black and white mosaic of the Neptune's house, located in the 2nd century Roman city Italica, was investigated in order study the lichen colonization of tesserae and mortars. Different strategies were observed. They lead to colonization of mosaic in such an extent that lichens clothe the represented figures, masking and affecting the esthetic value of this work of art.

Introduction

Italica is a Roman city located near Sevilla. It was founded in 206 b.C. by the Roman general Scipio Africanus, after the battle of Ilipa (Second Punic War) and represents the settelement of the first Roman people on the Iberian peninsula and the beginning of a rapid romanization.

During the 2nd century a.C. Italica was favoured by donations, public buildings, city walls and a new area of sumptuous residential quarters, the nova urbs.

After the 4th century a.C. there was a gradual decline of the nova urbs until it was finally abandoned.

The official archeological excavations began during the 18th century, but it was during the middle of the 19th century and this century when they developed.

The excavated part of the city offers the visitors a panorama of wide avenues and houses with a considerable number of black and white and polychromatic mosaics. These mosaics are protected from visitors by barriers and, because they were not cleaned periodically, algae, lichens and mosses, among other organisms, have the chance of developing on the rock substrate.

In this paper, a black and a white mosaic have been selected, located in the so-called Neptune's house, for investigating the lichen colonization. This represents the simplest case in which only two types of rocks are involved. Polychromatic mosaics with an ample variety of rocks present a more complicate colonization pattern with many species of lichens. This will be studied in a further paper.

Material and methods

The studied mosaic is located in the Neptune's house and appers to belong to the remains of an extensive villa of about 7000 m^2. The house contains 8 *opus tesellatum* and 1 *opus fliginum* pavements.

The black and white mosaic represented a repetitive hexagonal figure in which a star and a six petaled flower are inserted. The pavement dimensions are 4.90x4.50 m^2 and belong to the 2nd century A.C. (Rodriguez Hidalgo, 1987).

The tessera composition is marble and the cubes of about 1 cm^2 were regularity cut, showing a smooth surface. In general the pavement is well preserved, although some cracks cross over the mosaic. The lost surface represents about 22%. The conservation history is unknown although 15-20 years ago the tesserae were removed and included in a new support.

The most characteristic fact is the extensive lichen development on both black and white tesserae as well as on the mortar.

Results and discussion

Lichens are conspicuous pioneers on rock and initiate stages of succession. Mosaics are considered as a stable rocky substrate and the lichen communities have the chance of developing to maturity over long periods of time.

It is generally considered that a period of some years must pass before lichens establish themselves on new substrates (Seaward, 1977). The mosaics were excavated since 1919 and particularly between 1924 and 1932, although a few Italica's houses were excavated in the early seventies. During the elapsed time no regular cleaning to ensure removal of dust or organic matter deposition was done.

Different colonization strategies have been observed in the lichens colonizing the mosaics. They can be summarized as follows:

- Direct colonization on tesserae (Figure 1). The lichens are adapted to pioneer growth on bare rock and have the ability to adhere, penetrate and digest minerals. In general, the attack is both mechanical and chemical. Mechanically, the penetrating hyphae, by alternative swelling when wet and contracting when dry produce cracking. Chemical activities are represented by the synthesis and excretion of organic acids (e.g. oxalic acid) and lichenic acids (Syers et al., 1967; Iskandar and Syers, 1972).

This type of attach on the tesserae is exemplified, among others, by *Caloplaca* sp., a saxicolous, nitrophilous lichen with a typical crustose thallus without lower cortex (Brighman and Nicholson, 1977).

- Colonization of mortars and subsequent invasion of tesserae (Figure 2). In this case, the lichens have not enough ability for colonizing bare rocks due to a less pronunced pioneering character. Therefore, they thrive on a weathered substrate, the mortar, more adapted to support colonization. Pore size, desintegration and dissolution of minerals, a richer substrate and favourable water relations, all contribute to facilitate the exploitation of this environment. Lichens such as *Lecidea*

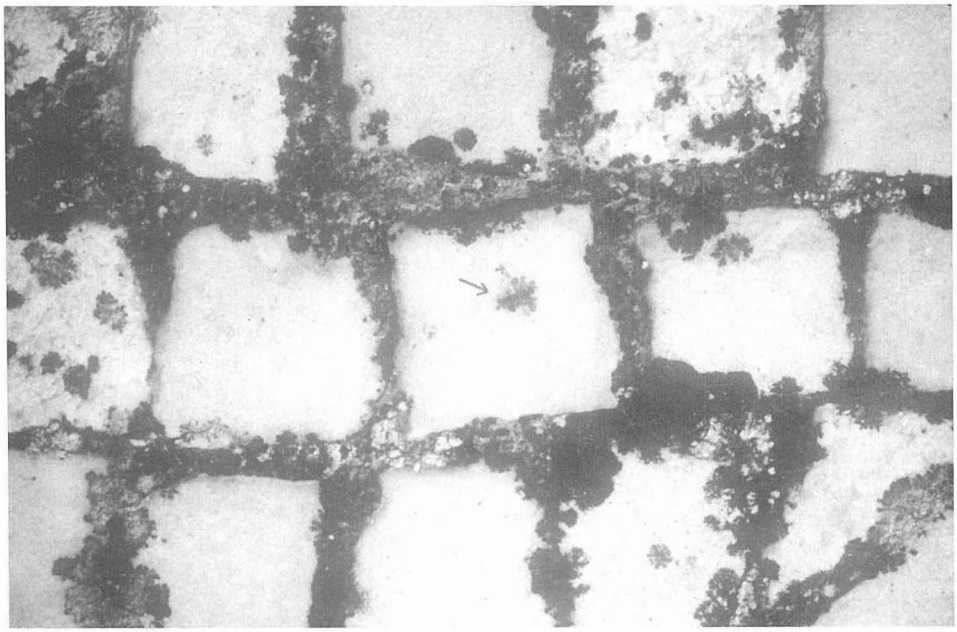

Fig. 1 - Direct colonization on tesserae. *Caloplaca* sp.

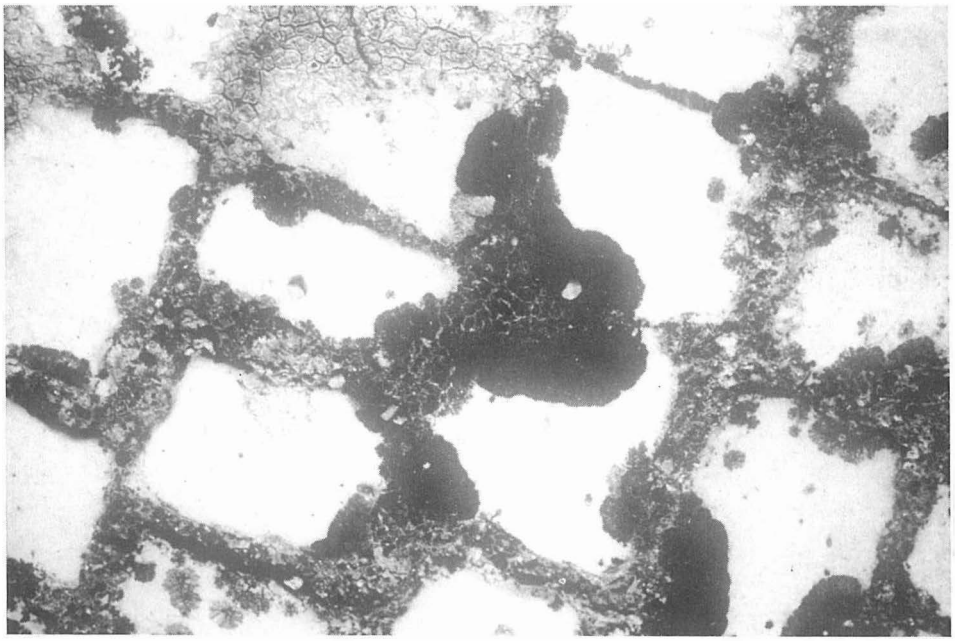

Fig. 2 - Colonization of mortar and subsequent invasion of tesserae. *Lecidea* sp.

Fig. 3 - Colonization of mortar and invasion of tesserae. *Aspicilia* gr. *radiosa*.

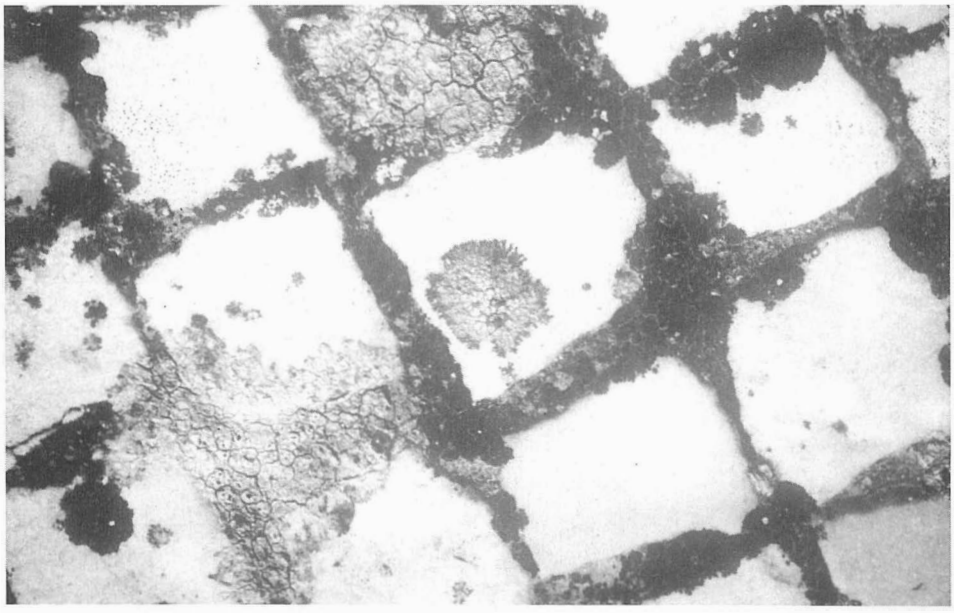

Fig. 4 - Non-specific colonization. *Aspicilia hoffmannii*.

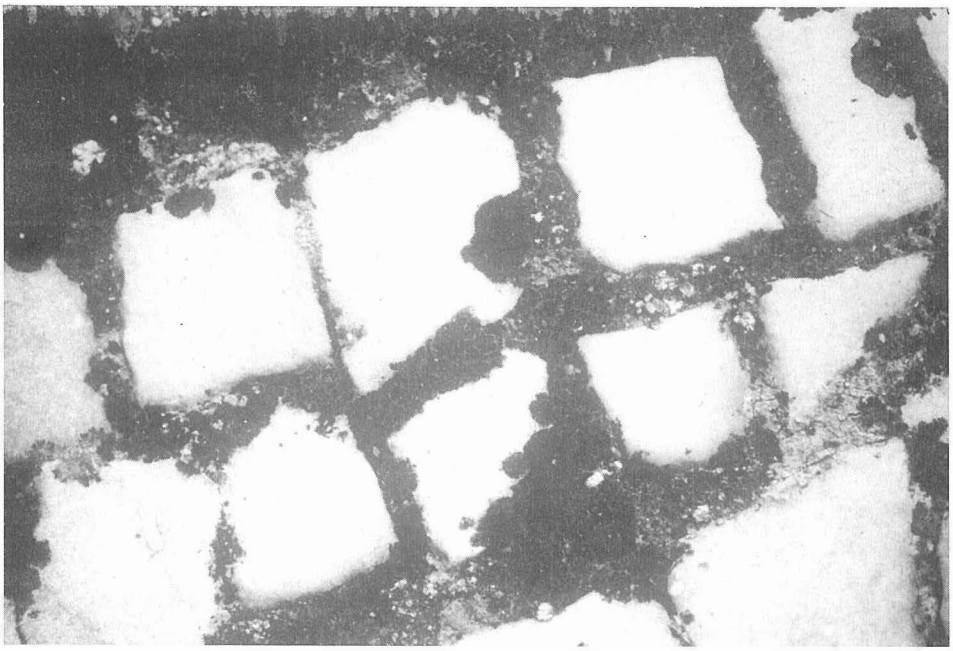

Fig. 5 - Lichenicolous species. *Caloplaca* sp.

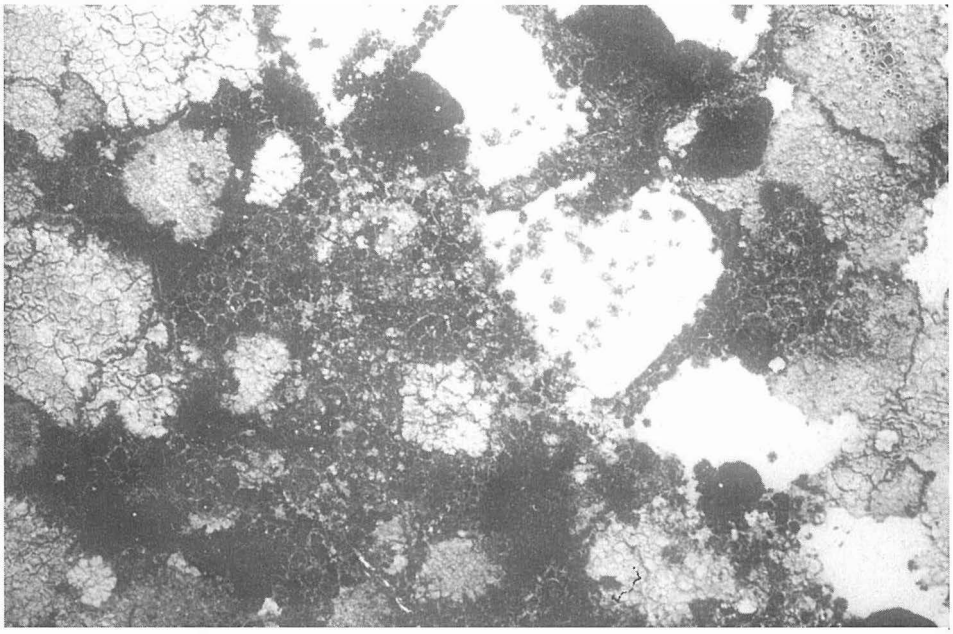

Fig. 6 - Stage of mosaic colonization leading to clothing of tesserae.

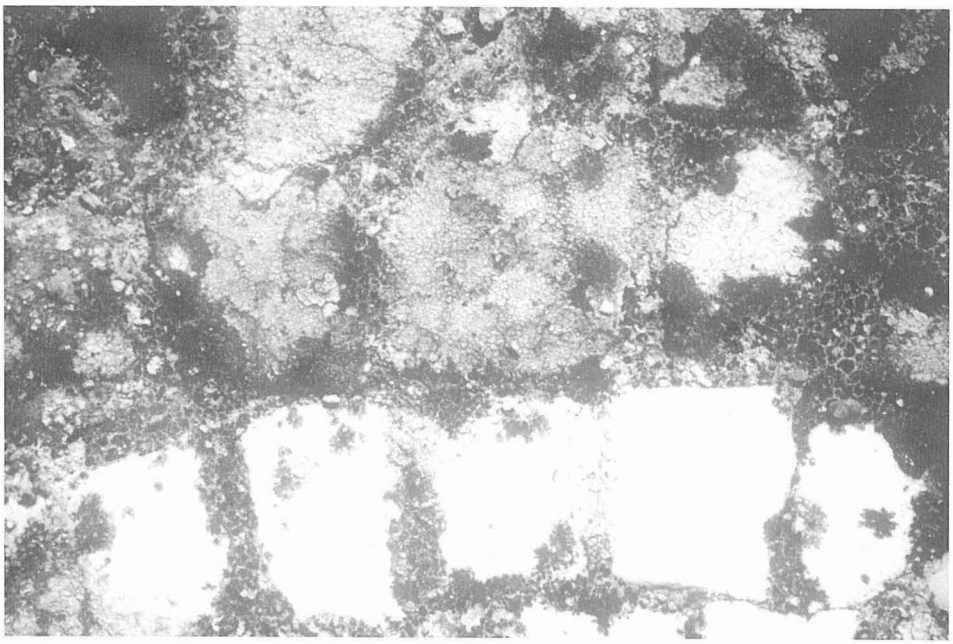

Fig. 7 - Same as Figure 6.

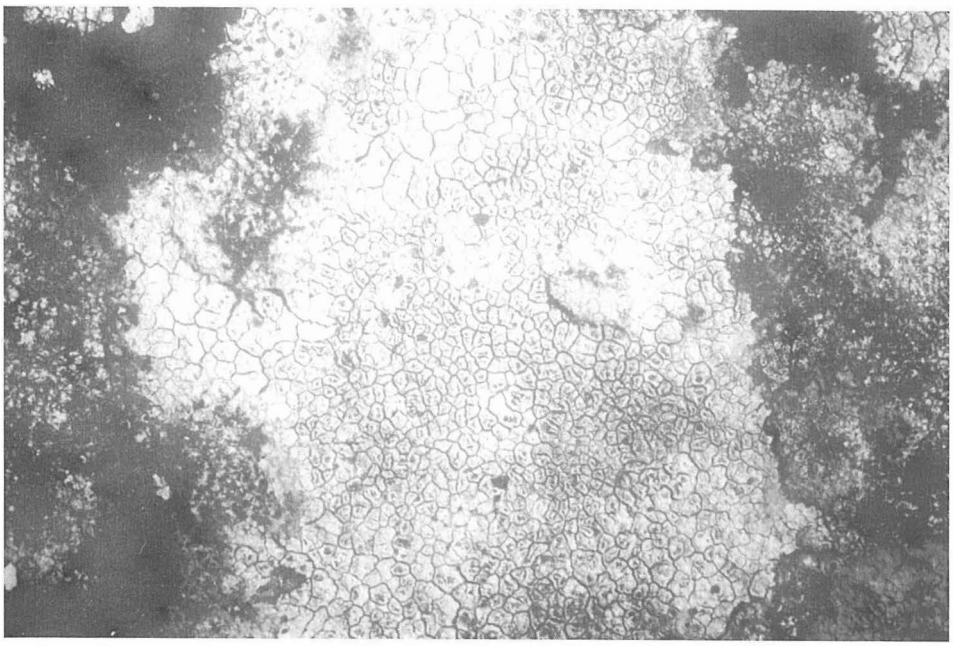

Fig. 8 - Same as Figure 6.

sp. or *Aspicilia* gr. *radiosa*, (Figure 3), with thick crustose thalli and an incipient lower cortex (Clauzade and Roux, 1985) characterize this strategy.

- There is another group of lichens with a less specific ecological behaviour. These lichens spread through both mortar and tesserae due to less exigent substrate requirements. This is the case of *Aspicilia hoffmannii* (Figure 4), with well developed crustose areolate and whitish-gray thallus.

These three types of colonization represent pioneering situation of the mosaic lichen community, defined as heliophylic, xerophytic and nitrophilous. After this, the maturity of the community leads to a fourth stage dominated by less pioneering lichen species, at least in the initial stage of development, such as *Caloplaca* sp. (Figure 5) and *Candelariella vitellina,* giving a colourful character typical of a mature lichen community (Wirth, 1980). In this last stage, the lichens "clothe" the mosaics, in such a way that they mask the figures, destroying their composition and aesthetic value (Figure 6-8).

Cleaning and removal of the lichens are being undertaken in order to preserve the mosaics.

Acknowledgements. This research has been supported by the CICYT through project CE87-0011.

References

Brightman F.H. & B.E. Nicholson, 1977. *Guia de campo de las plantas sin flores.* Omega, Barcelona, 214 pp.

Clauzade G. & C. Roux, 1985. *Likenoj de Okcidenta Europo. Ilustrita Determinlibro.* Bull. Soc. bot. Centre-Ouest, N.S., Nr. Spec. 7.

Iskandar I.K. & J.K. Syers, 1972. *Metal complex formation by lichen compounds.* J. Soil Sci. 23: 255-265.

Rodriguez Hidalgo J.M., 1987. *Mosaicos y Pavimentos. Italica.* Conjunto Arquelogico de Italica, Consejeria de Cultura, Junta de Andalucia, Sevilla.

Seaward M.R.D., 1977. *Lichen Ecology.* Academic Press, London, 550 pp.

Syers J.K., Birnie A.C. & B.D. Mitchell, 1967. *The calcium oxalate content of some lichens growing on limestone.* Lichenologist 3: 409-414.

Wirth V., 1980. *Flecthenflora.* Ulmer, Stuttgart, 522 pp.

Authors' Addresses

Departamento de Botanica
Facultad de Farmacia
Sevilla
and
Instituto de Recursos Naturales, C.S.I.C.
Apartado 1052
41080 Sevilla, Spain