

THE BEHAVIOUR OF SOME LICHEN SPECIES IN ANNABA AREA (ALGERIA)

SEMADI A. (*), TAHAR A. (*),
FADEL D. (*) and BENOIT-
GUYOD J.L. (**)

SUMMARY

The observation of lichen vegetation of the isolated trees in 162 stations allotted on a surface of 3240 km² permitted a census of 88 lichen species and to prepare for one of them a map of geographical assignation in the agro-industrial region of Annaba (Algeria).

The physiognomic spectre shows a dominance of the crustaceous species (52%) on the folious species (33%), gelatinous species (8%) and fruticolous species (7%).

The biogeographical spectre, indicating the origin of these species shows that 56% of taxa are subcosmopolitan, 21% cosmopolitan, 17% mediterranean, 7% european. Maps of geographical assignation are also established for the four principal substrata: *Fraxinus angustifolia*, *Olea europaea*, *Eucalyptus camaldulensis* and *Quercus suber*.

The lichen desert had been mentioned in the industrial area, nevertheless the use of certain species of lichens for monitoring the air pollution in the study area has occured significant results.

Key words: Lichens, pollution, monitoring, Annaba, Algeria.

INTRODUCTION

Atmospheric pollution of the industrial area of Annaba is a complex one that has origin two important plants: ASMIDAL (fertilizer factory) and SIDER (Siderurgical unity of EL HADJAR). In fact, to main acid components: sulfur dioxide and fluorine, are added to numerous other elements, causing a global effect of pollution of this type which is different of the sum of individual effects of each pollutant.

Safeguard of air quality requieres detection and measure of atmospheric pollution. In Annaba area, this safeguard has became a crucial problem because of the fremendous industry development. Because of the lack of phisico-chemical captors, it was necessary to determine prior the impact of this pollution trying to see the spatial distribution of the lichen flora in the region under study.

MATERIAL AND METHOD

Area of study:

The region is a rectangle 80 km long and 45 km wide, with a N.E. orientation. It was subdivided into a grid of 162 mesh 4 km X 5 km, (Fig. 1) according to the classic method of network cartography (CARTAN, 1978).

The co-ordinates of each mesh are precised by a number on X-axis and by a letter on Y-axis.

The dimensions of the sites are justified by the fact that the maps obtained may be thus integrated to the cut out into grades of adjusting mark international system; already widely used in Europe. The region under study covers 01 grade in Longitude and 0,45 grade in latitude and can be easily integrated in a map which has known coordinates.

Method of sampling

The lichen samples are made following a systematic squaring of the region under study. The whole region of Annaba, 162 sites have been explored in function of the presence of phorophytes and of there accessibility. In each station, we have examined between 01 and 10 trees of the same specie, not inclined and having a trunk diameter between 0,40 m and 01 m taken at 1,30 m up of the ground.

All the lichens that are present on the trunk have been noted. Sometimes, several species of phorophytes have been examined in the same mesh.

RESULTS AND DISCUSSIONS

Quantitative distribution of the lichens

The prospection of the lichens took place in the plains and hill sides, which represent 65% of squared region (Fig. 2, 3 and 4), The remaining (35%) was not studied because of the lack of phorophytes, or because of the difficulty to have access to mountain zones.

The sites where the number of taxa is superior to 20 is corresponding to forest of *Quercus*

suber of Oued El Aneb (N.W. of Annaba), *Olea europeae* of Asfour (S.E. of Annaba) and Cap de Garde (N of Annaba). These four sites are far from the pollution sources.

Physiognomic specter of the lichens

The physiognomic specter (Fig. 5) translates the dominance of crustaceous species (52%) and folioceous (33%) which together represent 85% of the total cortical flora; over the species of gelatinous thallus (8%) and fruticulous thallus (7%).

Comments on repartition maps

The examination of the different repartition maps of the lichen species does not allow to do deep conclusions whether or not air pollution has an influence.

One thing is sure however, and is the lack of lichen desert. As a matter of a fact, several species are found inside the agglomeration of Annaba and even up to the downtown; which is the case of *Bacidia rubella*, *Caloplaca cerina*, *Caloplaca* gr. *pyracea*, *Candelariella xanthostigma*, *Hyperphyscia adglutinata*, *Lecanora sienae*, *Physcia adscendens*, *Physcia biziana*, *Physcia tenella* et *Xanthoria parietina*.

In general, our observations go in the same way of that previously reported by others researches. We have noticed a decrease of a luxuriance and vitality, recovering degree, frequency reduction, of the abundance and the diversity with respect to urbanisation and industrialisation. We ended up to the same conclusions reported by LEBLANC (1961), DE SLOOVER and LEBLANC (1968, 1970), LEBLANC (1971), LEBLANC, RAO and COMEAU (1972), GILBERT (1973), JOHNSON (1973), LEBLANC, ROBITAILLE and RAO (1974), RIEUX (1977), ROSE (1985), TAKAOKI and MITANI (1986).

Precise data exist for *Physcia biziana*. It is a well known specie in mediterranean regions but also in Moravia, Bohemia, Austria and Tchecoslovakia. Its behaviour in regard to

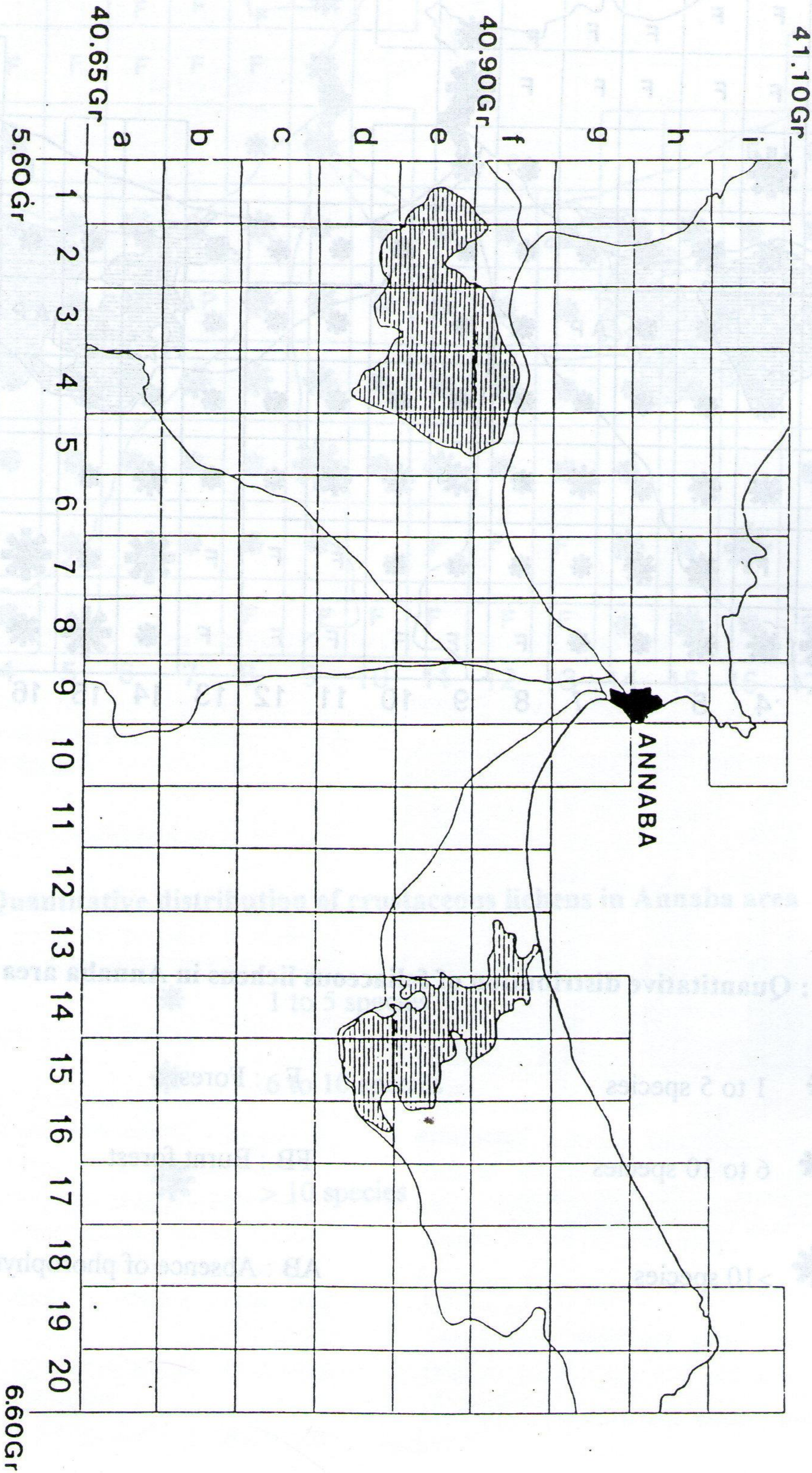


Fig. 1: Co-ordinates of studied area (Gr)

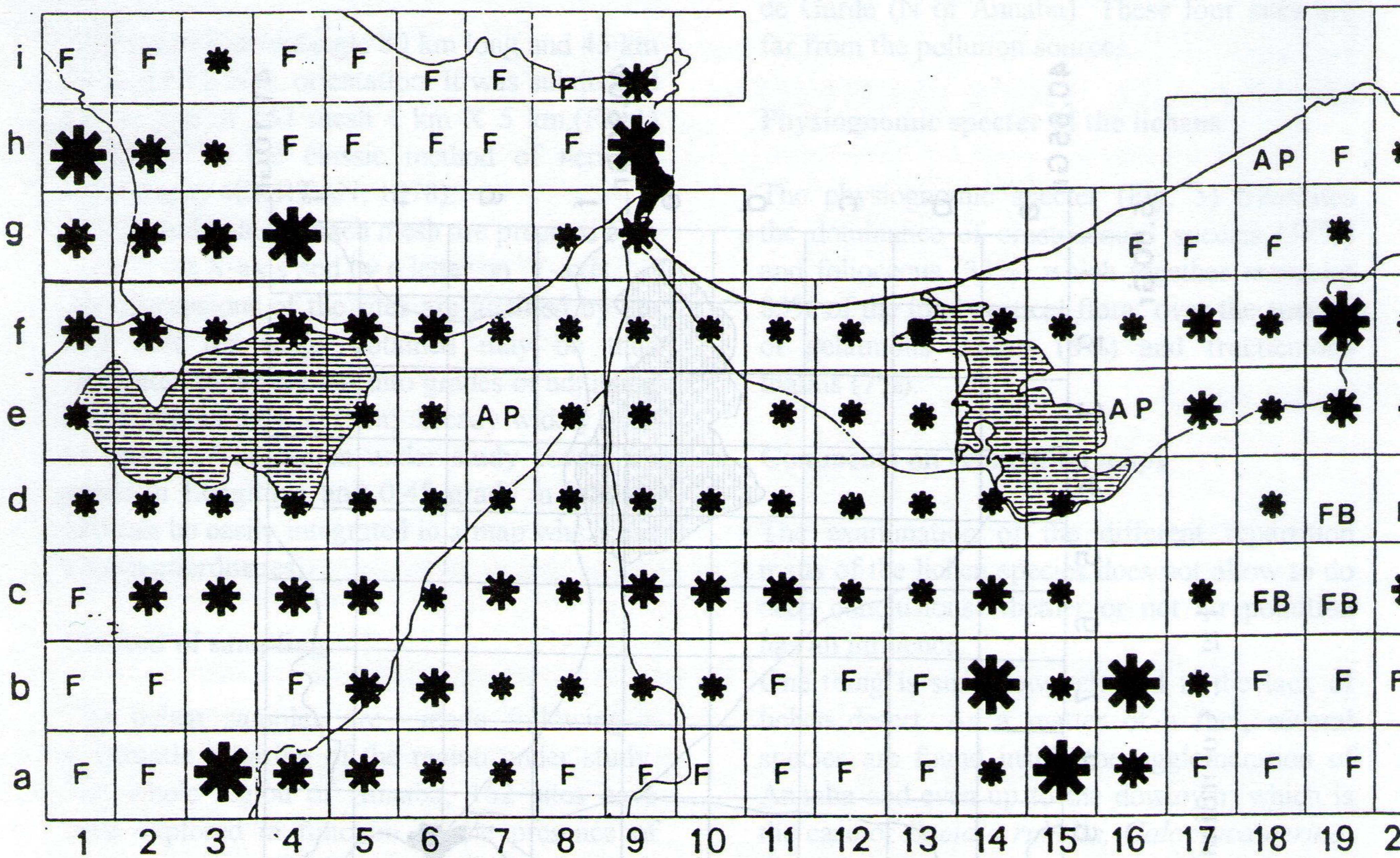


Fig. 2 : Quantitative distribution of foliaceous lichens in Annaba area

* 1 to 5 species

* 6 to 10 species

* >10 species

F : Forest

FB : Burnt forest

AB : Absence of phorophyte

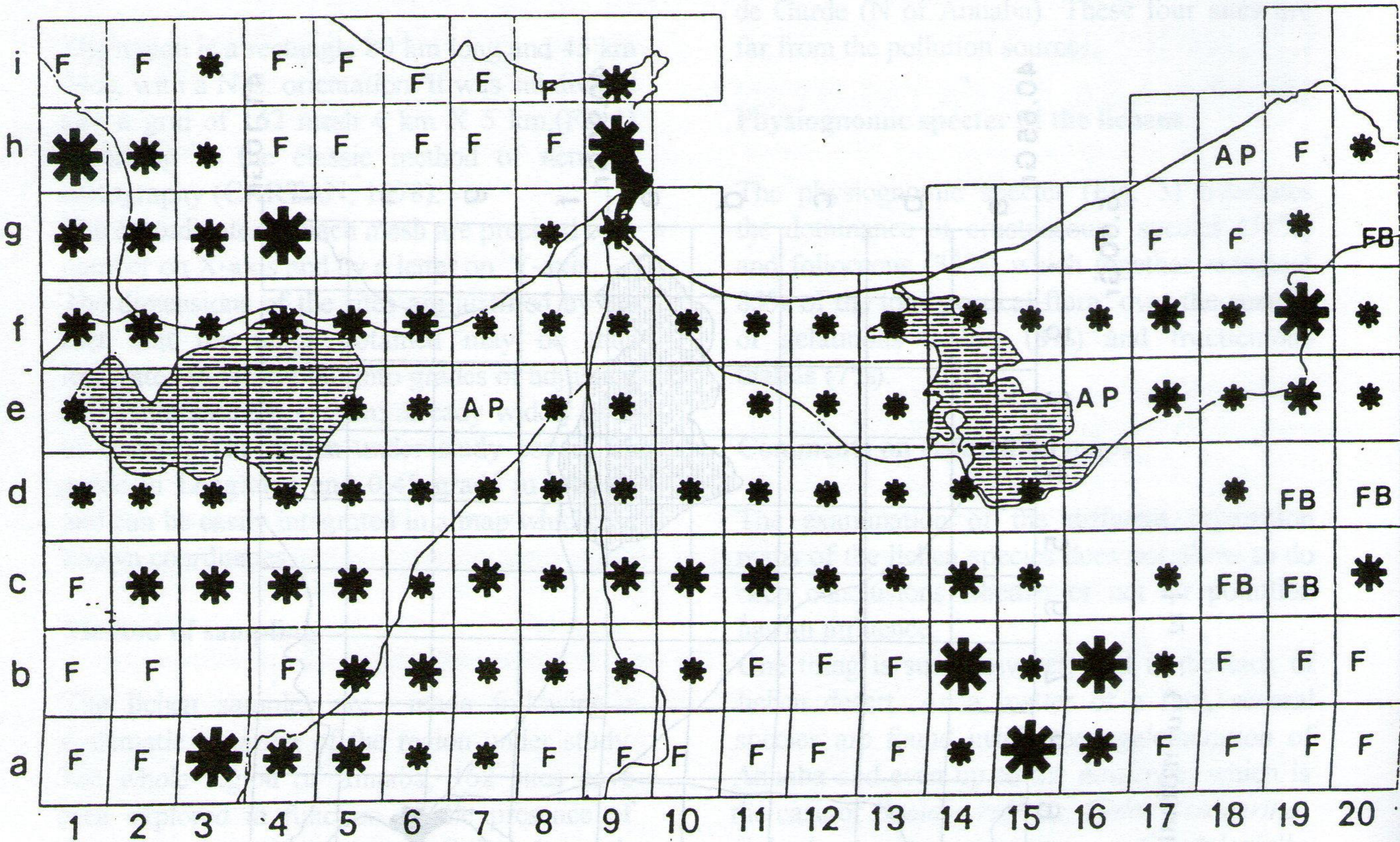


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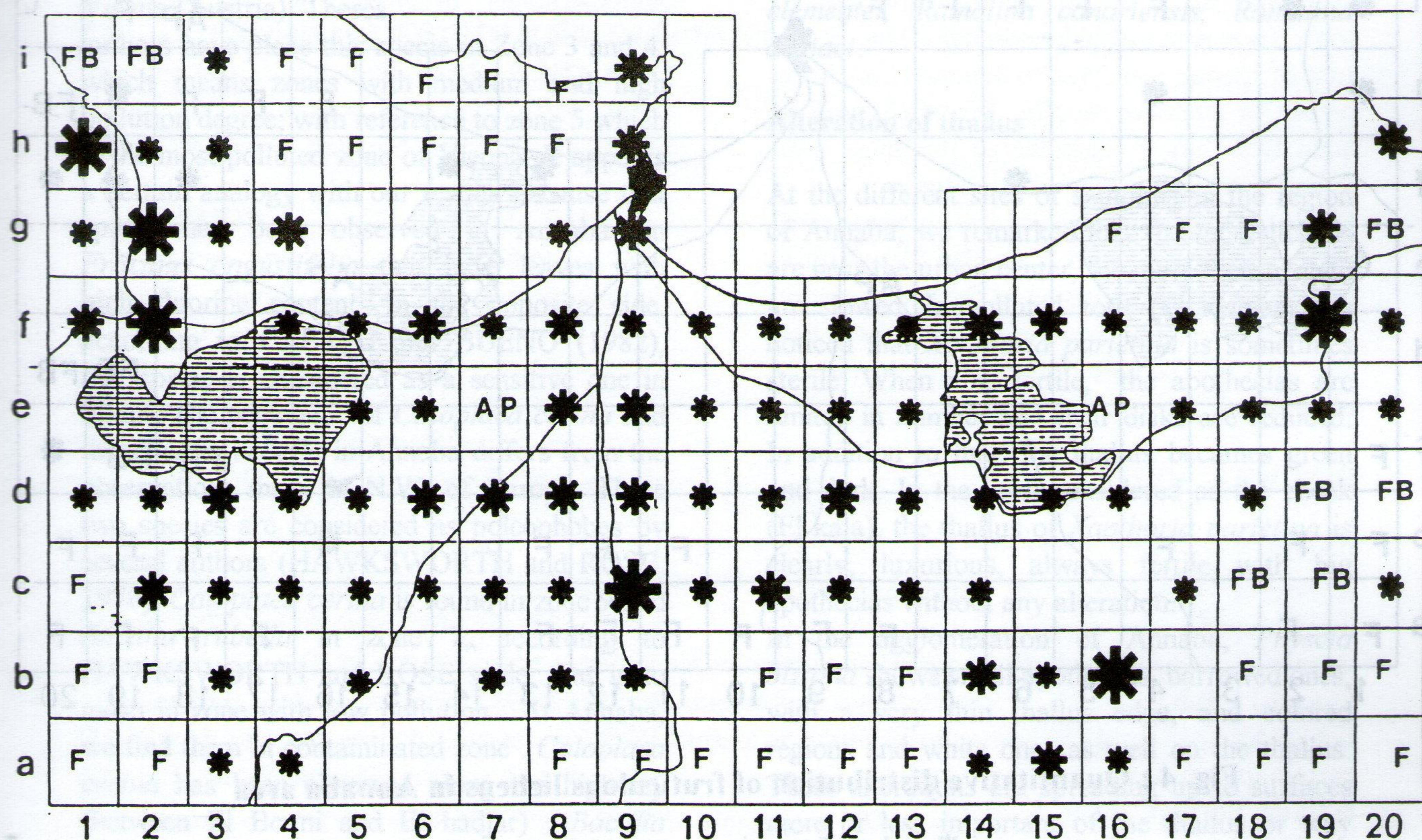


Fig. 3 Quantitative distribution of crustaceous lichens in Annaba area

- * 1 to 5 species
- * 6 to 10 species
- * > 10 species

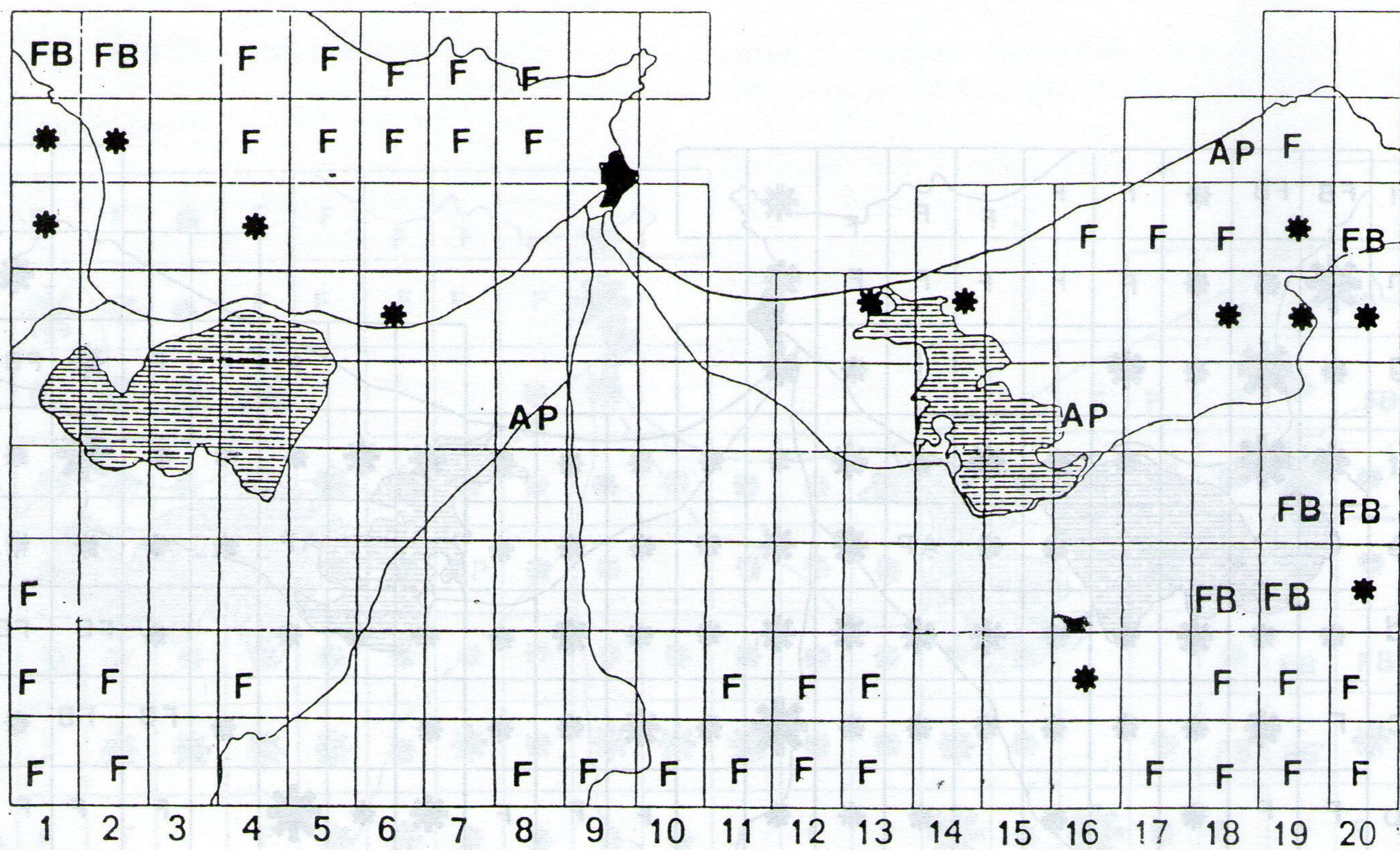
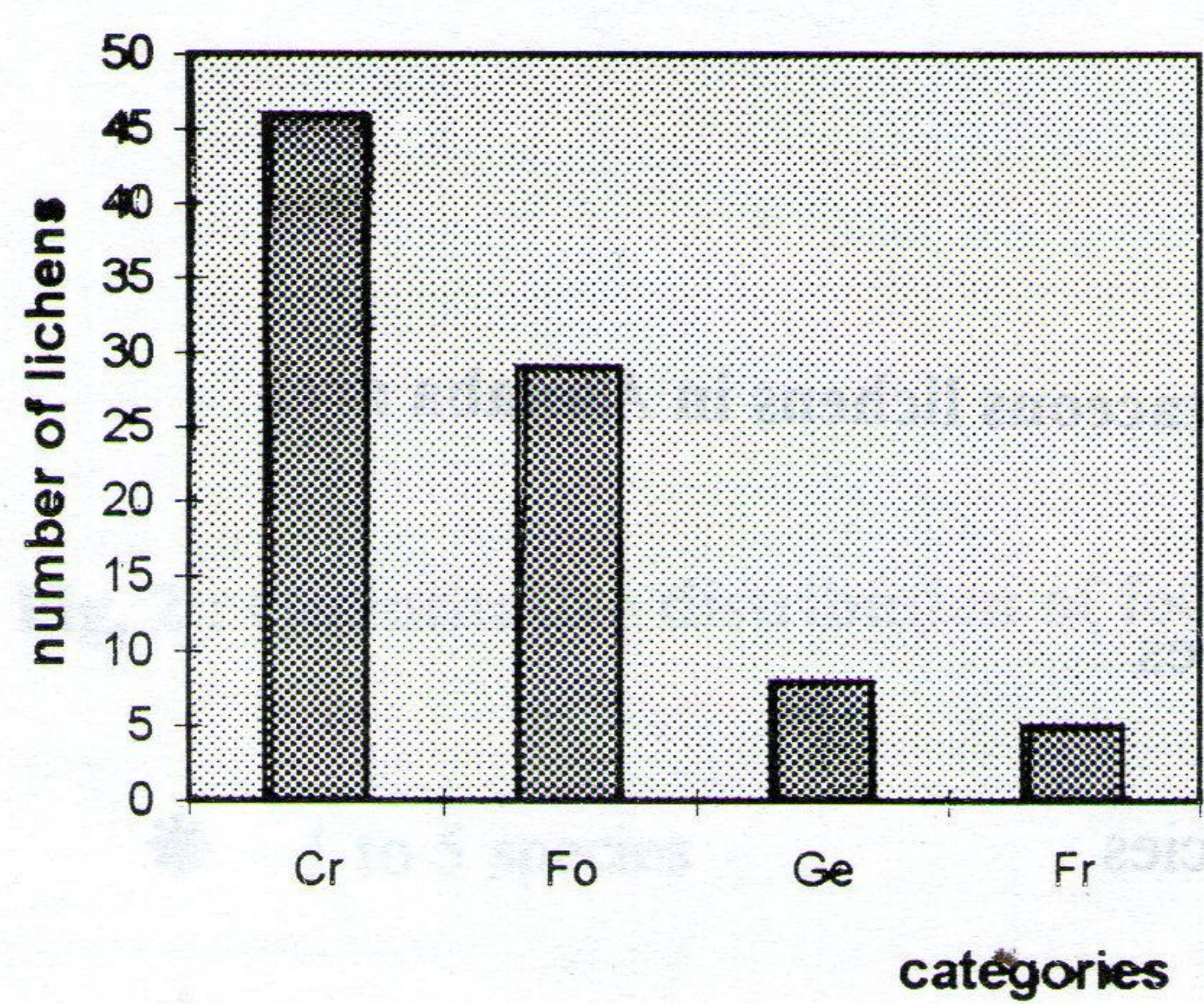


Fig. 4 : Quantitative distribution of fruticulous lichens in Annaba area

* 1 to 5 species



Cr: Crustaceous Fo: Foliaceous
Ge: Gelatinous Fr: Fruticulous

Fig. 5 : Physionomical spectrum of lichens in Annaba area.

pollution has been studied by LASOTA-CHRIST and TURC (1984) for the city of Vienna (Austria). These authors have placed this species in Zone 3 and 4, which means zones with medium and high pollution degree; with reference to zone 5 which is the most polluted zone of Vienna. It appears a certain analogy with our results because that species has been observed in Annaba on *Fraxinus angustifolia* that have leaves with high fluorine content. In the opposite side, according to CRESPO and BUENO (1982), this species is considered as a sensitive one in Spain. The behaviour of *Caloplaca cerina* and the *Bacidia rubella* in Annaba differs from the observations made in N.W. of Europe. These two species are considered as poleophobes by several authors (HAWKSWORTH and ROSE, 1970). *Caloplaca cerina* is found in zone 9 and *Bacidia rubella* in zone 7, according to HAWKSWORTH and ROSE scale, that is to mean in zone with low pollution. At Annaba, we find them in contaminated zone. *Caloplaca cerina* has been observed along the highway (between El Bouni and El hadjar). *Bacidia Rubella* colonises *Fraxinus angustifolia* and *Curpressus sempervirens*, inside the agglomeration of Annaba.

Set up of atmospheric pollution scale

At the light of our results in the region of Annaba, we are going to propose a scale of poleophoby for the main taxa that have been observed.

Three categories of lichens can be distinguished:

1. Resistant taxa (penetrating to city)

Bacidia rubella, *Caloplaca cerina*, *Caloplaca* gr. *pyracea-holocarpa*, *Candelariella xanthostigma*, *Hyperphyscia adglutinata*, *Lecanora sienae*, *Physcia adscendens*, *Physcia biziana*, *Physcia tenella*, *Xanthoria parietina*.

2. Taxa with medium resistance (rural and suburban areas)

Groupe *Phaeophyscia orbicularis*, *Physconia grisea*, *Diploicia canescens*.

3. Taxa that are particularly poleophobes sensitive

Parmelea caperata, *Parmelia soledians*, *Parmelia perlata*, *Parmelia tiliacea*, *Physcia clementei*, *Ramalina canariensis*, *Ramalina duriaei*.

Alteration of thallus

At the different sites of sampling in the region of Annaba, we remarked that the more lichens are near the urban center, the more their growth are slowed. In polluted zone (El Hadjar), we noticed that *Xanthoria parietina* is sometimes sterile. When it is fertile, the apothecias are limited in number and their disks are reduced. In addition to that, the thallus becomes green and dark. In the zone considered as the check (El kala), the thallus of *Xanthoria parietina* is clearly, luxurious, always fertile with big apothecias without any alteration.

In the agglomeration of Annaba, *Physcia biziana* shows small apothecias, narrowed ones, with a very thin thallus edge, and colored regions and white ones as well on the thallus. These alterations are spreading up to surfaces more or less important of the thallus or way reach to whole area. This is the case of thallus which are developing on *Fraxinus angustifolia* and *Robinia pseudo-acacia* in front of Ibn Sina hospital.

Among the crustaceous species, we point out *Lecanora sienae* on different phorophytes which becomes colorless and dies. It undergoes an important erosion (disappearance of Hymenium) which does us enable to identify it. The same type of alteration has been observed by RIEUX (1977) in the zone of Fos-Sur-Mer on *Lecanora sienae* and *Lecanora chlorotera*. SEAWARD (1976) has noticed that air pollution induced inhibition of fertility on lichens. BEDENEAU (1980) has observed in zone with medium pollution, big and white resious due to parasite fungi.

CONCLUSION

The results obtained allow to draw some original conclusions and put a certain number of problems.

The inventory of lichens in Annaba region is an important contribution of the knowledge of a mediterranean lichen flora, the behaviour of some species was made possible. This is the case of species like *Physcia biziana*, *Caloplaca cerina* or *Bacidia rubella*. We shall keep in main their larger tolerance to pollution, with reference to classic data of literature.

Finally, the establishment of this inventory will deserve its value when a regular follow up is made. Thus, the regression of the some species, the progression of others, even the apparition of new taxa will be able to testify the variation of air quality.

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(*): Institut des Sciences de la Nature Université d'Annaba - 23000 - Annaba (Algérie)

(**): GEDEXE, Université Joseph FOURRIER MEYLAN - GRENOBLE (France)