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Biochemical changes during morphogenesis of *Picoa juniperi* vitt. sporacarps

Juliet O. Ewaze, Manhal Al – Naama*[1], Makarem Alabdul and Raaid K. Hussain

Biology Department and Chemistry Department[1], College of Education, Basrah University, Basrah – IRAQ

SUMMARY

Picoa juniperi vitt. is one of several truffles found in Iraq. A brief description of this species is provided in this paper, The chemical compsition for immature and mature sporocarps of this fungus was investigated. It is particulary rich in protein and carbohydrate.

Polyacrylamide gel electrophoresis was used to determine the banding patterns of total solube proteins at two developmental stages of sporocarps. The patterns shows similarities in the number of protein bands, except that, there was an additional band with Rp Value 0.28 of high molecular weight which appeared in the extract of mature ascocarp. This protein band could be related to the autolysis mechanism.

The whole analysis showed that the Sporocarps of this fungus could be considered nutritionally as a good source of carbohydrate and protein.

Introduction

Five species of hypogeous truffles are common in Iraq. These are *Terfezia claveryi* Chatin; *Terfezia boudieri* Chatin; *Tirmania nivea* (Desf. exFries) Trappe; *Tirmania pinoyi* (Maire) Malençon and *Phaeangium lefebvrei* Patouillard. *Helianthemum* species have been mentioned as probable mycorrhizal hosts for these desert truffles (1 & 6).

Picoa juniperi Vittadini is another type of truffle, which belong to the Balsamiaceae family, order Pezizales and subdivision Ascomycotina. In Iraq. it grows particularly well in Samawa. (a town in western Iraq) and commonly occurs with *Helianthemum* spp. in desert habitats. Whether or not they form Mycorrhizae with *Picoa* remains unknown. The growth of such truffles is related to the early rainfull season in Autumn. The tubers are cultivated by hand and marketed, and it has a considerable economic value in Iraq as they provide a much desired source of food. Little information is available about its chemical composition and nutritional value; Trappe (10) devoted attention only to taxonomical studies.

The present study is aimed at presenting some knowledge about the chemical composition and nutritional status of this fungus grown in Iraq.

Material and Methods

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Organism

The samples used as a source for the sporocarps stages were collected from the Iraqi desert (Samawa – desert) during the period January to April (1987). Thirty samples of each stage were examined to record morphological features of the fungus throughout the whole season. Specimens were deposited at the herbarium, College of education, University of Basrah, Juliet 702, 703 and in Oregon State University herbarium cited as Trappe number 11239, 11238.

Chemical Analysis

Fresh ascocarps of the required age (immature and mature) were weighed and dried in an oven at 60 °C for 24 (hr), colled in a desicatar, and reweighed. The dried tissues were grounded in a mortar and used for analysis without further manipulation.

Total proteins were determined colorimetrically by the Biuret method (5) using a Proteins – Kit from BioMerieux (France). Carbohydrate was estimated by the anthrone reagent according to the method of Norris and Ribons (9). Total lipids were determined colorimetrically with Sulfophosphovanillic Mixture (7) using a Lipides – Kit from BioMerieux (France).

Electrophoresis

Total soluble protein patterns were determined by polyaccrylamide gel electrophoresis according to the method of Laemmli (8). A mortar and restle were used to grind the tissue before protein was extracted. 7.5% gel concentration was used. The run was carried out at a constant current of 100mA. The instrument used was the LKB 2001 Vertical electrophoretic unit.

Results and Discussion

The chief diagnostic features of this species were 2–4 spored asci, ong stipitate when immature, and 8 – clustered spored asci, generally astipitate at maturity, with prominent polygonal warts on the sporocarp's surface (Table 1 & Fig. 1). It was concluded that these features generally fit the description given by Trappe (10).

Chemical analysis often provides new information that adds to the overall knowledge and precise characterization of this species as well as to find the nutritional value of this type of fungi.

Table 2 presents the analyis sof some constituents of two stages of ascocarps *Picoa juniperi*. This tpye of fungi tends to show a good nutritional value, especially on the basis of their protein. It was found that protein contents on a dry basis, were 10.8 and 14.6%, for immature and mature stages respectively. These results are similar to the observation of AL– Delaimy (2) who found the protein value of the white and black varieties of truffles to be 18.8% and 16.2% respectively.

In addition to the principle protein reserves, it is becoming evident that this type of truffle also contains a considerable amount of carbohydate as indicated in Table 2. Percentages of carbohydates as high as 21.5% and 24.7% had been recorded in the immature and mature ascocarps. It should be noted here that the carbohydrates values are very similar to the values of other types of truffles found by Al – Naama *et al* (3).

There is an increasing need for knowledge about proteins since they are known to play an important role in the morphogenesis of organisms. To study the proteins in *Picoa juniperi*, the same developmental stages (Table 1) of sporocarp were analysed for soluble protein in 7.5% polyocrylamide gel. Fig 2 shows similarities in their electrophoretic patterns except that, there was an additional

band of high Molecular Weight (Rp 0.28) which appeared in the extract of mature ascocarp. However the mature stage demonstrated moderate to high intensity for most of the bands. This remarkable high protein content found at this stage of development is noteworthy and this may reflect the high metabolic demands made for the maturation of asci and ascospores within the fruit body. Assuming that the pattern of protein synthesis reflects, at least partially, the outcome of a developmental programme, one could conclude that maturation of asci and ascospores induces a large number of biochemical processes. The function of these proteins is unknown. Clare *et al* (4) suggested that the soluble fungal proteins have an active cellular function. On the other hand the additional band that appeared at this stage (mature stage) could be the protein related to the autolysis mechanism, which initiates a number of biochemical processes; these processes might be spore maturation, asci degradation, odor formation of fruit body etc.

These results may indicate that this type of truffle could supply reasonable amounts of protein of high nutritional value if consumed as a food source.

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Key Words: Picoa juniperi, Mycorrhizae, Electrophoresis, Truffles, *Helianthemum*.

Fig. 1. *Picoa juniper*. Vitt. Upper, mature ascocarp gleba (right) and surface (left). Lower, immature ascocarp gleba (right) and surface (left).

Fig. 2. Polyacrylamide gel electrophoresis of total proteins isolated from late stage ascocarp (Slot 2) and immature stage ascocarp (Slot 3) of *Picoa juniperi* Vitt.
Molecular weight standards of ovtransferrin "hen egg" (78,000), bovine serum albumin (66,300), Chymotrypsinogen (25,700),

myoglobin (17,200) Cytochrome C (12,300) were present in Slot 1.
Most intense bands are represented by solid lines, those of intermediate intensity by banded lines, and weak bands my dotted lines.

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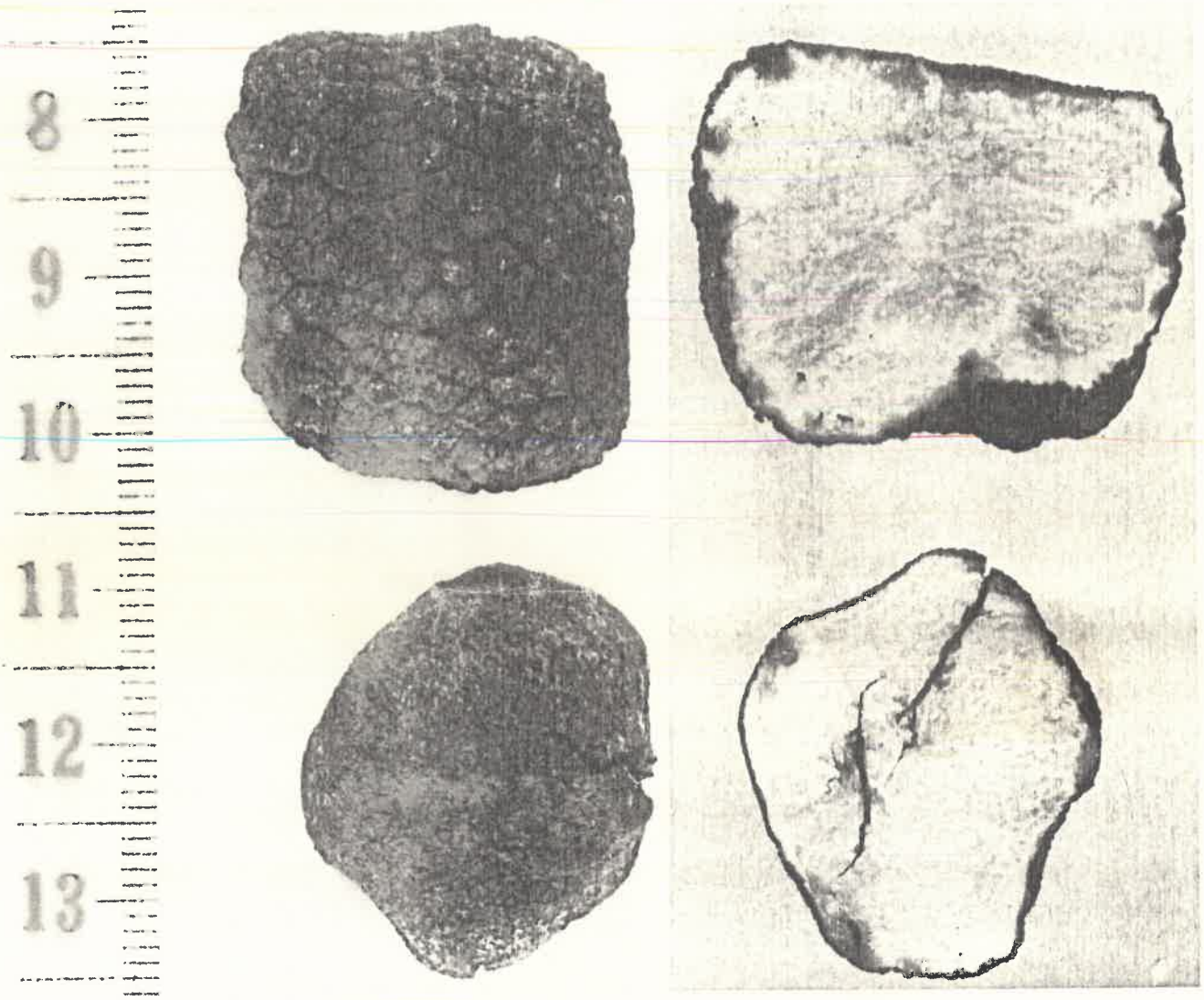

Fig 1

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Table 1. Developmental stages of *Picoa juniperi* Vitt. sporocarps.

Maturity of Sporocarps	Description
Immature	*Sporocarps*: subglobose to ellipsoid or irregular, 1–3 Cm in diam, surface pale brown to brown and obscurely verrucose. Gleba: Solid, White in colour. Asci: 2–4 spored, ellipsoid to obvoid, hyaline walled, stipitate 4–6 × 50–72 µm. Ascopores: globose or occasionally subglobose, 23–25 µm, surface smooth.
Mature	*Sporocarp*: subglobose to ellipsoid, 3–7 cm in diamater, dark brown or black with prominent polygonal warts, peridium 0.5–4.0 mm thick, subangular to globose cells. Asci: 8 – clustered spores, elliposoid to obvoid, 62–90 µm, thin walled, non amyloid, and generally astipitate. Ascopores: globose or occasionally subglobose, 26–28 µm, ornamented with crowded minute spines.

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Table 2. Chemical Composition (% Wt.) of immature and mature sporocarps of *Picoa juniperi* Vitt. based on dry ascocarps.

Maturity of Sporocarp	Protein*	Carbohy-drates*	Lipid*
Immature	10.8	21.5	1.64
Mature	14.6	24.7	2.75

* Average of Triplicates.

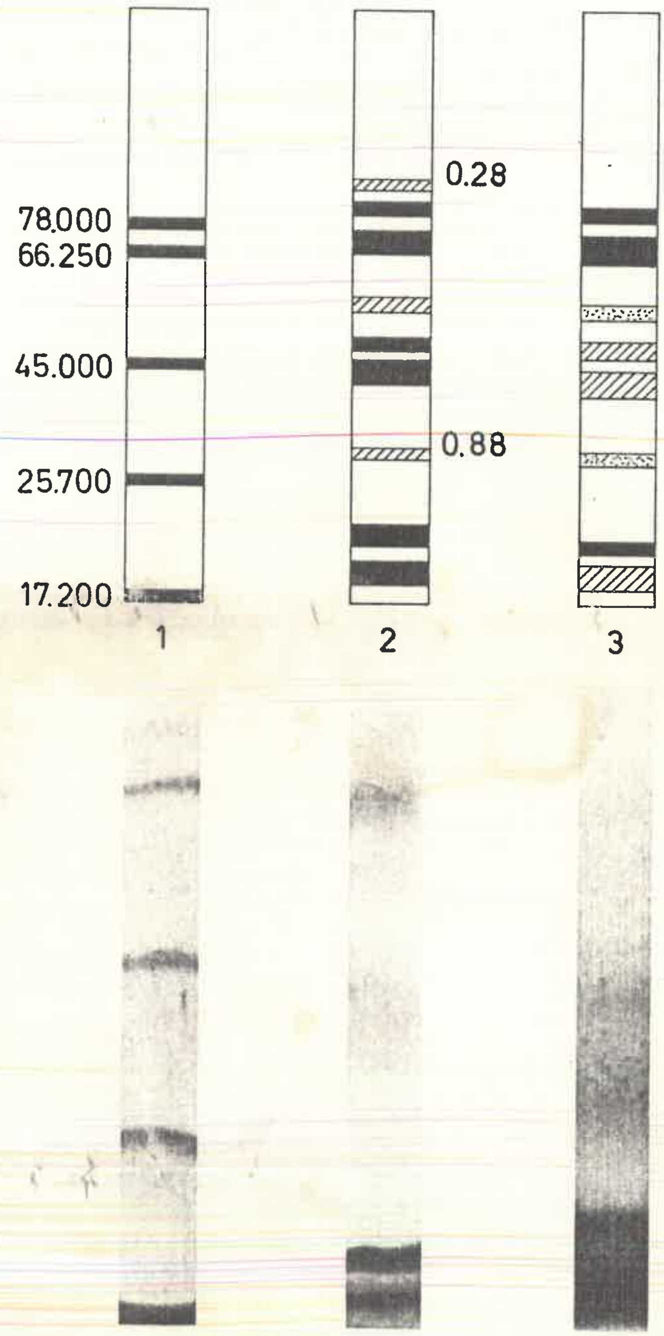

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Fig. 2