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BRIEF COMMUNICATIONS

POLYPRENOLS FROM *Ficus carica* LEAVES AND THEIR BIOLOGICAL ACTIVITY

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Ficus carica L. (Moraceae) is the fig fruit tree and is called the fig tree. The useful properties of figs have been known since antiquity. Figs are used in folk medicine as an infusion for gargling, as a poultice for colds, and as an emollient for abscesses and tumors [1, 2]. Japanese scientists proposed an antitumor drug from figs [3]. Figs are very useful for strengthening the heart because they contain much potassium. Figs lower the blood cholesterol level. Their ω-3 and ω-6 fatty acids are necessary for the cardiovascular and nervous systems [4].

Decoctions of the leaves cure cough, bronchial asthma, and kidneys [5]. The plant leaves are rich in furocoumarins, psoralen, and bergapten. The drug Psoberan from fig leaves is approved for medical use and can cause photosensitization by increasing pigment formation in skin [6]. Psoralen and essential oil isolated from leaves possessed fungicidal and bactericidal activity [7]. Also, ascorbic acid, rutin, tanning agents, and resins have been observed in them [8]. However, polyisoprenoids from *F. carica* have not been studied.

The literature on polyprenols (PP) from plants indicates high contents of them in several studied plant families such as Pinaceae (1.0–1.25%), Malvaceae (1.0–4.0%), Moraceae (1.0–1.5%), Sterculiaceae (1.0–5.0%), Vitaceae (1.0–2.0%), etc. [9–13]. However, the PP contents in a single genus can vary, e.g., in plants of the genus *Ficus*. Thus, although *F. altissima*, *F. craterostoma*, *F. trangularis*, *F. subrepanda*, etc. contained ~0.2–0.5% PP, *F. religiosa* contained only 0.01% PP of the mass of fresh plant [13]. That research found PP in leaves of these plants, mainly with 9–12 isoprene units.

The present communication reports results for PP from two samples of *F. carica* leaves growing in Surxondaryo (sample 1) and Samarkand Regions (sample 2). The samples were collected in September 2020.

The raw material was extracted by alternative methods, i.e., infusion and ultrasound (US) stirring with EtOH by the literature method [14]. It was found that US extraction increased the yield of total extracted substances (TES) and PP.

PP were isolated by condensing the EtOH extracts to 1/3 the volume and working them up with dilute KOH solution to remove free fatty acids. The remainder was saponified by an aqueous EtOH solution of KOH (6%) to produce unsaponified fractions (UF) in 0.4–0.64% yields of the air-dried mass (ADM). The PP content in the total UF was determined using HPTLC (Camag, Switzerland) without fractionation. PP from *Rhus coriaria* [15] were used as standards with 42.27% PP-10, 42.35% PP-11, and 14.57% PP-12.

Table 1 presents data showing that the use of US extraction helped to increase the TES yield in samples 1 and 2 by 1.5 and 1.6 times; PP, by 1.3 and 1.5 times. The PP content according to HPTLC analysis of total UF obtained from *F. carica* leaves collected in Samarkand Region (68.89%) was greater than from those in Surxondaryo Region (53.90%). A determination of the homologous composition of PP in the UF showed that all fractions were dominated by undecaprenol (71.72–79.68%) and dodecaprenol (20.32–28.28%) with decaprenol observed only in sample 2 with the use of US.

Next, ballast constituents of PP in UF of *F. carica* leaves collected in Samarkand Region were studied using an Agilent Technologies GC-MS. The analytical results showed that the main constituents were the diterpene alcohol phytol (28.12%); psoralen (11.24); ethyl esters of the fatty acids palmitic (10.26), linolenic (14.39), and linoleic (18.19); triacetin (1.76); and neophytadiene (0.99).

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TABLE 1. PP Content in Leaves of *Ficus carica*

Sample	TES yield, %	UF yield, %	PP-10	PP-11	PP-12	PP content in UF, %	PP yield, % of ADM
Infusion							
1	6.28	0.40	–	77.99	22.01	54.79	0.22
2	7.84	0.45	–	79.68	20.32	67.52	0.30
US, stirring							
1	9.26	0.52	4.77	73.26	21.96	53.90	0.28
2	12.82	0.64		71.72	28.28	68.89	0.44

The minor constituents included 2,3-dihydrobenzofuranone (0.35%), acetic acid (0.35), 2-pyrrolidinone (0.07), *n*-hexadecane (0.04), and 2,5-bis(1-naphthamido)terephthalic acid (0.04).

The antibacterial and antifungal activities of TES and PP from *F. carica* leaves collected in Samarkand Region were studied against several Gram-positive and Gram-negative bacteria and the fungus *Candida albicans* using the agar disk-diffusion method [16]. The results of the *in vitro* tests showed that all tested samples exhibited weak antibacterial activity against the studied bacteria strains. The extract from *F. carica* leaves that was obtained using US was most active against the Gram-positive bacteria *Bacillus subtilis* (8 ± 0.12 mm) and *Staphylococcus aureus* (7 ± 0.11 mm).

Thus, US extraction could increase the yields of extracted substances and UF from the two samples and extract the PP-10 fraction. The PP content was greatest in the plant growing in Samarkand Region. TES from *F. carica* were observed to have weak antibacterial activity against Gram-positive bacteria.

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