

# Phytochemical Investigation and the Anti-cancer properties of *Pergularia daemia* and *Phylica paniculata*

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## INTRODUCTION

During 1997 the Council for Scientific and Industrial Research (CSIR) implemented an in-house anti-cancer screen aimed at testing several plant extracts. This was done in collaboration with the National Cancer Institute (NCI) in the USA and involved training of CSIR staff at the NCI. Currently the CSIR screens extracts *in vitro* for anti-cancer activity against a panel of three human cancer cell lines namely, melanoma **UACC-62**, renal carcinoma **TK-10**, and breast adenocarcinoma **MCF-7**. Extracts of *Phylica paniculata* Willd. (Rhamnaceae) and *Pergularia daemia* (Forsk.) Chiov. (Asclepiadaceae) exhibited anti-cancer activity at the CSIR screen and were screened by the NCI against sixty human cancer cell lines organized into sub panels representing leukaemia, melanoma and cancer of the lung, colon, kidney, ovary and central nervous system.

There are no records of previous biological or phytochemical studies on *P. paniculata*. A phytochemical report on the related species *P. rogersii* describes the isolation of the four alkaloids reticuline, methylcoclaurine, isocorydine and laurosoltzine.<sup>1</sup>

*P. daemia* (Forsk.) Chiov. is a wild herbaceous creeper with milky latex and hairy stems and is used as fish poison.<sup>2</sup> Root decoctions are taken for venereal diseases, arthritis, muscular pain, asthma and rheumatism.<sup>3</sup>

## RESULTS AND DISCUSSION

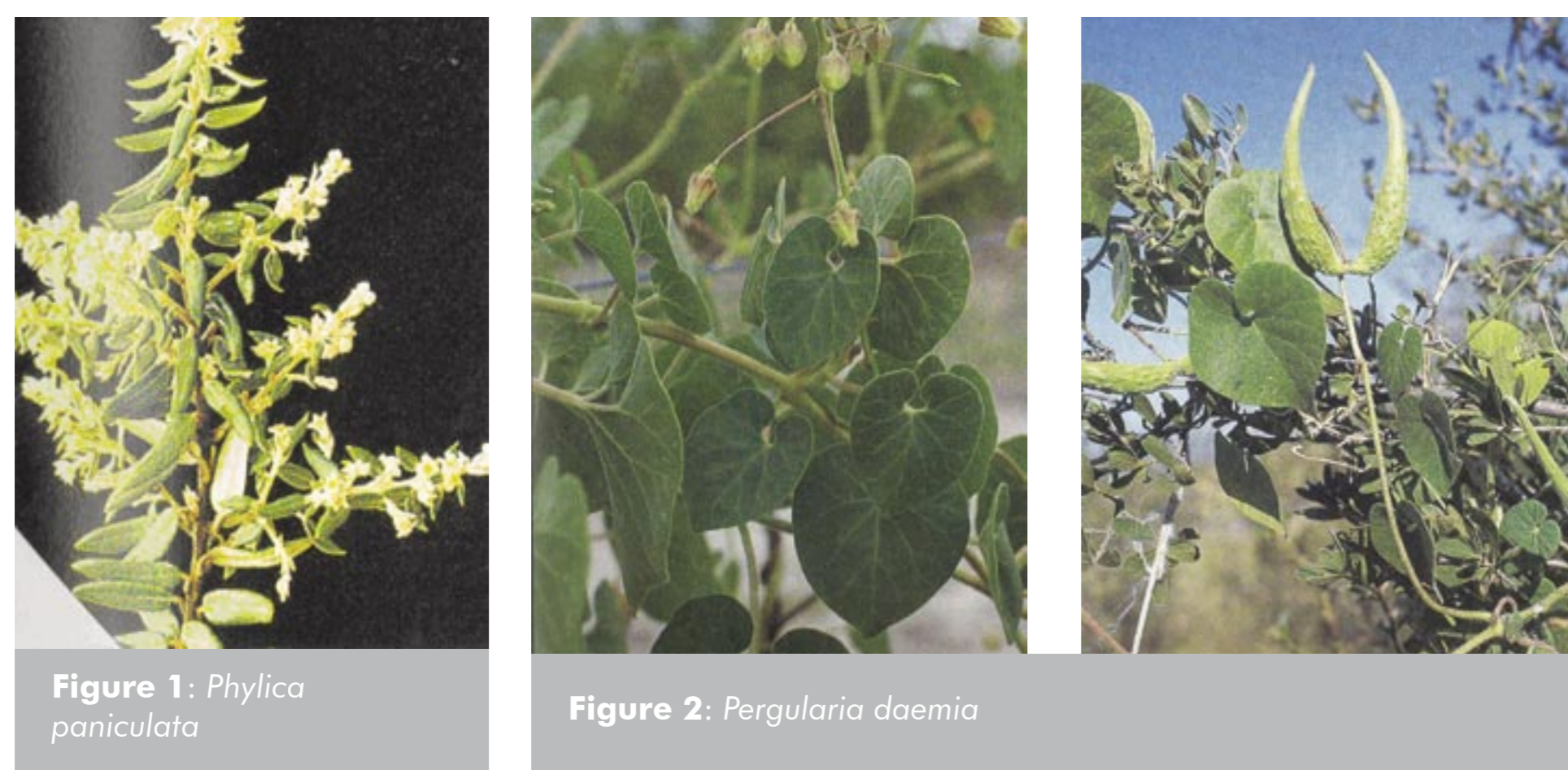


Figure 1: *Phylica paniculata*

Figure 2: *Pergularia daemia*

### *Phylica paniculata*

The methanol-dichloromethane (1:1, v/v) extract of the aerial parts of *P. paniculata* exhibited low anti-cancer activity in the CSIR's in-house screen. Liquid-liquid partitioning of this extract generated a dichloromethane fraction that showed increased anti-cancer activity compared to the original extract (see **Figure 3**). The results were also confirmed by the NCI against the sixty human cancer cell lines (**Table 1**). The bioassay-guided fractionation of the dichloromethane fraction afforded the isolation of the triterpenoid ursolic acid as the active compound (**Table 2**). Its molecular formula was established as C<sub>30</sub>H<sub>52</sub>O<sub>2</sub> from the FAB-MS data at *m/z* 456.7003.

### *Pergularia daemia*

Plants were collected from KwaZulu Natal in South Africa and the methanol-dichloromethane (1:1 v/v) extract of the whole plant inhibited the growth of the cancerous cells when tested both at the CSIR and NCI (see **Table 1**). Repeated flash chromatography of the organic extract afforded the isolation of five compounds that were characterized as  $\beta$ -sitosterol glucoside,  $\beta$ -sitosterol,  $\alpha$ -amyrin, 3-O-acetyl- $\alpha$ -amyrin and a disaccharide, sucrose.

These compounds showed no significant anti-cancer activity against the CSIR's three cell lines, except  $\alpha$ -amyrin that exhibited low potency (**Table 2**). Furthermore, substitution of the hydroxyl group at position 3 of  $\alpha$ -amyrin with the acetate functionality resulted in loss of activity. This finding suggests that the presence of the hydroxyl group at position 3 is important for the inhibition of the growth of cancer cells.

**Table 1:** Growth inhibition of the cancerous cells by the plant extracts

Plant	Extract Type	Plant Part	CSIR Results <sup>(a)</sup>	NCI Results
<i>P. paniculata</i>	MeOH/CH <sub>2</sub> Cl <sub>2</sub> (1:1)	Aerial part	Low activity	Low, no selectivity
<i>P. paniculata</i>	CH <sub>2</sub> Cl <sub>2</sub> fraction	Aerial part	Moderate activity	Moderate; leukaemia, NSCLC <sup>(b)</sup> , PC-3 prostate
<i>P. daemia</i>	MeOH/CH <sub>2</sub> Cl <sub>2</sub> (1:1)	Whole	Low activity	Low; NSCLC, renal, prostate

(a) Low activity = Total growth inhibition (TGI) between 15 $\mu$ g/ml and 50 $\mu$ g/ml  
 (a) Moderate activity = TGI between 6.25 and 15 $\mu$ g/ml for two to three cell lines  
 (a) Potent activity = TGI < 6.25 $\mu$ g/ml for two to three cell lines  
 (b) NSCLC = Non-Small-Cell Lung Cancer

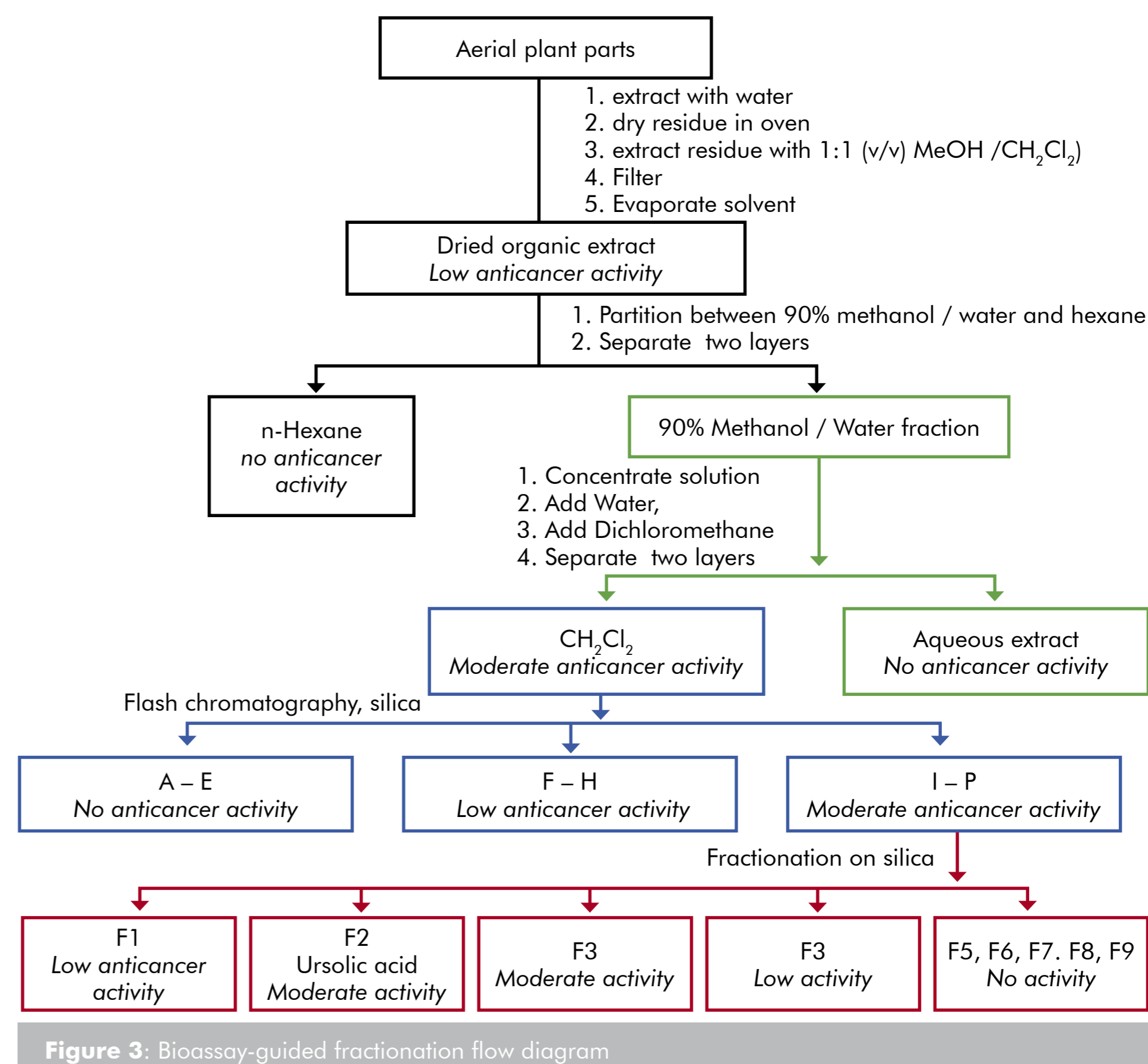
The structures of all the compounds were elucidated using <sup>1</sup>H and <sup>13</sup>C NMR and mass spectral techniques. The structures were also confirmed by comparison of the spectroscopic data with published data.

**Table 2:** Structures of the active isolated compounds and their anti-cancer activity

Compound	Graphs of anti-cancer activity
 ursolic acid	
 $\alpha$ -amyrin	

## CONCLUSION

None of the compounds isolated from *Pergularia daemia* have shown any significant anti-cancer activity; however the search for the active compound is still ongoing. Ursolic acid was isolated as the active constituent from *Phylica paniculata* and this compound and its derivatives have been patented for their anti-cancer properties by other scientists.<sup>4</sup> Triterpenoids play a vital role as anti-cancer agents and structural modification of this class of compounds can result in the establishment of an innovative drug for the treatment of cancer.



**Figure 3:** Bioassay-guided fractionation flow diagram

## REFERENCES

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