DETERMINATION OF ENERGY CONTENT, PHYTOCHEMICAL CONSTITUENTS AND ANTIOXIDANT ACTIVITY OF POTENTIAL WILD EDIBLE LEGUME; CANAVALIA ROSEA (SW.) DC. FROM NORTHERN KERALA

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ABSTRACT
Objective: Major objective of this study is to determine the calorific value and antioxidant activity of Canavalia rosea.
Methods: Petroleum ether extract of the seeds were tested qualitatively for twelve components. Calorific value in kJ/100g seed flour was determined based on the results of the proximate analysis. Enzymatic and non-enzymatic antioxidants were analyzed by standard procedures using UV-Visible Spectrophotometer.
Results: C. rosea is a perennial creeper with roughly circular compound leaves. Flowers are brightly pink-purple, in racemes. It is having large fruits up to 8-12 cm, with brown dormant seeds inside. Seeds were collected from banks of ‘Kabani’ River (Panamaram) and from various tribal hamlets in Wayanad district, Kerela. Preliminary phytochemical screening reveals the presence of eight compounds such as, tannins, saponins, flavonoids, cardiac glycosides, terpenoids, phenols, coumarins and phlobatannins. The analysis of nutritive value of seed has a higher value of crude protein (48.71 %) and crude carbohydrate (34.07). The calorific value of seed material was 1529.9kJ/100g seed flour. Enzymatic antioxidants superoxide dismutase (38.134 u/mg fw) and catalase (19.051 u/mg dw) then non-enzymatic antioxidants poly phenols (12.81 u/mg dw) and ascorbic acid (10.301 u/mg fw) were tested. All these tests show significant levels of antioxidants in the sample.
Conclusion: Hence, the present study providing details about the place of collection, ethnobotanical information, energy content and antioxidant activity of Canavalia rosea.
Keywords: Legume, Calorific value, Antioxidants, Canavalia rosea

INTRODUCTION
Legumes have been considered to be an economical dietary source of protein and are higher in protein than most other plant foods [1]. Consumption of legumes is recommended in the daily diet not only because of its protein; more than that legumes are also rich with other nutrients, dietary fibers and many useful phytochemicals [2]. Human interference such as industrialization, deforestation, pollution etc was badly affects the distribution of pantropical legumes like Canavalia rosea, Canavalia martimis, Canavaloalucatharrhoi [3]. But, Canavaloalucatharrhoi regenerates well, probably due to seed dormancy [4]. The genus Canavalia includes four subgenera with 51 species [5]. One of the most common members of this genus is Canavalia rosea [6]. Perennial creeping legumes C. rosea and C. cathartica are dominant sand binders associated with rhizobia, endophytic fungi and arbuscular mycorrhizal fungi bound abundantly on sand dunes in India [7, 8].

C. rosea is ecologically important in costal ecosystems, where it is a pioneer species on sand dunes [9]. Typical habits of C. rosea are beach, the backshore above the high tide mark, but it can sometimes climb over rocks and occasionally, it can grow near the shore of costal lagoons and roadsides [10].

Ethnobotanical inferences are available for the usage of root infusion, plant decoction, seed powder, leafpaste etc of C. rosea to treat pain and aches [11]. The young pods and seeds were occasionally used for edible purposes by forest dwellers living in Wayanad district of northern Kerala. They consume the seed meal along with their regular diet only after decanting several times and thorough cooking [12].

In this context, seeds of under-utilized tribal legume C. rosea were powdered and evaluated the energy content and antioxidant property. This under-exploited species (C. rosea) may serve as future food source [13, 14]. So that it is important to investigate the nutritional quality and calorific value of this wild legume.

MATERIALS AND METHODS
Collection of sample
Seeds were collected from banks of Kabani River, Panamaram, Wayanad district, Kerela and moist deciduous forests near the vicinity of tribal hamlets situated in and around Bathy retyaluki, Wayanad district, Kerela (fig. 1). Samples were pooled together before analysis.

Fig. 1: A. Habit of C. rosea, B. Inflorescence

Preparation of sample and qualitative analysis
Air-dried seeds (fig. 2) were weighed before putting into oven. Then incubate the seeds in an oven at 80°C for 24 h. Then the sample was...
The use of the plant in ethnomedicine [48]. Known to have ability to inhibit or act against gastrointestinal moieties like saponins, cardiac glycosides and flavonoids or even from animal predators [47]. The presence of glycoside nutritional point of view [46]. But these chemicals were synthesized without antioxidant property and are undesirable from the phlo.

Components like cardiac glycosides, tannin, saponin, flavonoid etc by the protocol described by [15]. Assayed according to the method of Ginnopolitis and Ries [22]. The absorbance was recorded at 560 nm against the blank.

Non enzymatic antioxidants
Ascorbic acid content activity was estimated by the method of Mulherje and Choudhari [23]. Standard curve was made by a known concentration of ascorbic acid in 6% trichloroacetic acid. Total polyphenol content determination was done by the method suggested by Folin and Denis [24].

Statistical analysis
The statistical analysis was done by using Microsoft excel. Each set of data is an average of triplicates and it represents a mean±standard error.

RESULTS AND DISCUSSION
C. ensiformis, C. cathartica and C. gladiata, are some of the closest relatives of C. rosea [25]. Among the four species of Canavalia, C. rosea is comparatively not much explored. Nutritional and anti-nutritional components in C. ensiformis were well studied [26]; and it contains components like tannin [27], saponin [28], phytic acid [29], and polyphenols [30] moderately in high quantities [31]. Several studies on C. gladiata revealed the quantity [32] and the quality of secondary metabolites present in their seeds [33]. Most of the phytochemical components in C. cathartica were also analysed [34] and quantified earlier [35].

Canavalin A is the most studied plant lectin [36] found abundantly in genus Canavalia. It is a potential chemical constituent having wide range of applications in the field of isolation of immunoglobulins, blood group substances etc. And also has a role in anti-viral medicine [37]. Canavanine [38] and canaline are the specific analogue of arginine and are non-protein toxic amino acids [39] richly found in Canavalia species [40].

Every genus will definitely shows its own unique chemical profile during the qualitative tests. Among the twelve compounds tested Canavalinosea shows the presence of saponin, tannin, flavonoid, terpenoid, phlobatannin, cardiac glycosides and total phenol (table 1). Many of these compounds are potentially significant against human pathogens [41]. Tannins are capable to inhibit digestive enzymes [42], while saponin can reduce the nutrient uptake [43]. Phenolics [44] and flavonoids are widely distributed in plants and are having powerful antioxidant activity [45], this legume is also rich in phenolics but most of the phenolic content was destroyed during cooking and steaming [30].

Table 1: Results of phytochemical screening of seeds of Canavalia rosea

| S. No. | Phytochemical compounds | Petroleum ether extract of seed |
|--------|-------------------------|---------------------------------|
| 1      | Tannin                  | +                               |
| 2      | Saponin                 | +                               |
| 3      | Flavonoid               | -                               |
| 4      | Quinones                | -                               |
| 5      | Glycosides              | +                               |
| 6      | Cardiac glycosides      | +                               |
| 7      | Terpenoids              | +                               |
| 8      | Phenols                 | -                               |
| 9      | Coumarins               | +                               |
| 10     | Steroids                | -                               |
| 11     | Phlobatannins           | +                               |
| 12     | Anthraquinones          | -                               |

Components like cardiac glycosides, caumarins, terpenoids, phlorotannins, and tannins are secondary metabolites with or without antioxidant property and are undesirable from the nutritional point of view [46]. But these chemicals were synthesized and deposited in the plant tissue for protecting them from microbes or even from animal predators [47]. The presence of glycoside moieties like saponins, cardiac glycosides and flavonoids, which are known to have ability to inhibit or act against gastrointestinal infections are of pharmacological importance and give evidence to the use of the plant in ethnomedicine [48].

Coming to the results of proximate analysis (table 2) Canavalinosea shows the highest amount of crude protein (48.71%). The amount of moisture in the seeds is an important factor influencing seed viability. Generally seeds with higher moisture content will have a lower shelf life. Canavalinosea is having 13.94% moisture content. The percentage of ash content is an indicator for the quality of mineral nutrients present [10], and these seeds possess 3.51% of ash content. Then these seeds possess 3.90 % of crude fat and 9.81 % of crude fiber. Crude carbohydrate is also one among the nutrients, this sample contain 34.07 % of the same.
On eating this legumes man and animals [49] will definitely get lots of natural antioxidants [50]. Antioxidants are substances which can inhibit oxidative damage by preventing the action of reactive oxygen species [51], and they are the first line of defense mechanism in neutralizing the free radicals [52]. Superoxide dismutase (SOD) and Ascorbic acid were tested in fresh tissues while tests for Catalase and Polyphenols were done by using dry seed samples, and the results reveals that the seeds of C. rosea contain 38.134 units of SOD, 19.051 units of catalase, 12.81 units of polyphenols and 10.301 units of ascorbic acid per mg seed flour.

### Table 2: Proximate composition

| Components                      | Percentage     |
|---------------------------------|----------------|
| % Moisture content              | 13.94±0.90     |
| % Ash content                   | 3.51±0.01      |
| % Crude fiber                   | 9.81±1.12      |
| % Crude fat (Ether extract)     | 3.90±0.8       |
| % Crude protein                 | 48.71±1.02     |
| % Crude carbohydrate (NFE)      | 34.07          |
| Calorific value                 | 1529.9 KJ/100g seed flour. |

### Table 3: Antioxidant composition

| Plant name                | SOD (unit/mg FW) | Catalase (unit/mg DW) | Polyphenols (unit/mg DW) | Ascorbic acid (unit/mg FW) |
|---------------------------|------------------|-----------------------|--------------------------|--------------------------|
| Canavaliarosea           | 38.13±1.67       | 19.05±1.01            | 12.81±0.62               | 10.30±1.13               |

### CONCLUSION

This study helps us to conclude that the wild bean C. rosea, rich in phytochemicals thus should be exploited more as a medicinal proteinaceous food. This can also be used as a potential ingredient to formulate nutraceutical products for medicinal and veterinary applications. In vivo antioxidant activities of this beneficial wild bean along with the aspects of nutritional quality such as food efficiency ratio, net protein retention, protein retention efficiency, true digestibility, biological value etc need to be investigated further.

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### AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

### CONFLICT OF INTERESTS

The authors have no conflict of interest to report.

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