usefulness and diverse benefits of camel milk are the hot topic of current research. Although the studies are preliminary, the observations are significant in terms of the benefits revealed. These studies have stressed the requisite to further explore camel milk as probiotics.

Very few studies have been carried out with respect to the isolation and characterization of probiotic bacteria from camel milk. The earlier study revealed the predominant genera as *Lactobacillus* and *Lactococcus* have different phenotypes, viz. gas production from glucose, arginine hydrolysis, fermentation of other 20 carbohydrates, inhibitory effect against *Salmonella typhimurium* ATCC14028, *Escherichia coli* 8739 and *Staphylococcus epidermidis* and production of bacteriocins[1,2]. Studies also showed they have capacity to tolerate Oxgall (2%), pH (3.0) and simulated intestinal juice, and mostly sensitive to common antibiotics also[3]. Previous reports have stated that camel milk has a very high concentration of mono- and polyunsaturated fatty acids, albumin, immunoglobulins, vitamin E, manganese and iron, helping in numerous functions being performed by the body. It has proven applications in diarrhoea, diabetes, hepatitis C and B, and reduction of cholesterol in the blood. Camel milk has no allergic response in children; it improves the immune system. Also, the use of camel milk and urine has led to a reduction in the growth of cancer cells[4,5].

Furthermore, the composition of camel milk is unique compared to that of other ruminants[6]. Camels from India and Pakistan can produce up to 12,000 l of milk in the lactation period from 9 to 18 months[7], which is very high compared to camels from all over the world[8]. The level of vitamin C is three times higher than that of human milk. During drought conditions, the concentration of sodium, potassium, phosphate and chloride in milk increases, while urea concentration remains unchanged. The lactose milk sugar can be easily digested by those suffering from lactose intolerance[8]. The defensive milk proteins such as lysozyme, lactoferrin and lactoperoxidase are also present. Camel milk also has insulin which remains available for absorption in the intestine as the milk does not coagulate in an acidic environment. There is also strong evidence that intake of raw camel milk can reduce the dose of insulin required for glycaemic control, and zero prevalence of diabetes among camel milk-consuming Raica community of northwest Rajasthan, India has been noted[9]. Further research is necessary to isolate the actual protective factor in camel milk for anti-diabetic properties.

The studies discussed here have provided vital insights into the camel milk chemistry and bacterial composition. Further research on adhesion to human mucosal and non-mucosal cell lines, cell cytotoxicity assay, production of short-chain fatty acids, auto-aggregation, co-aggregation, antioxidant activity and exopolisaccharide production is necessary. Also, camel milk proteins, especially insulin can be tested for prebiotics. Data on these aspects are currently unavailable and organized research is essential to target the probiotic bacteria. Moreover, the roles played by these bacteria in human health and understanding the microbial community dynamics in the gut environment of humans need to be explored.

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Polyembryony in *Psophocarpus tetragonolobus* (L.) DC. from Kerala, India

Psophocarpus tetragonolobus (L.) DC. is commonly known as winged bean or asparagus bean. The plant is a twinning perennial herb belonging to the family Fabaceae. Almost every part of this plant is tasty and edible. The protein and oil content of the plant is comparable to soybean[1]. Moreover, the winged bean extract inhibits both wrinkle formation and lichenification of the epidermis in human chronic eczematous dermatitis[2]. Delayed and poor germination of seed is a serious problem of this crop. The low percentage of seed germination is attributed to its hard seed coat rather than to seed dormancy. Many studies have debated about seed viability and seed priming strategies for germination of winged bean[3–5]. So far there is no report on polyembryony. The present study was conducted to examine germinability of different genotypes of

Table 1. Morphological parameters of pods and seeds in *Psophocarpus tetragonolobus*

		Pod			Seed			
Place of collection	Accession code	Average length (cm)	Average thickness (mm)	Number of seeds	Average length (mm)	Average thickness (mm)	Average breadth (mm)	Average weight (mg)
Karyavattom	PT-KTM	15.2	5.9	12	7.5	7.0	6.3	387.3
Olanad	PT-OLD	19.9	7.6	13	7.4	7.3	6.6	392.9
Wayanad	PT-WYD	26.0	14.0	15	9.9	8.4	9.4	546.5

Figure 1. Polyembryonic condition in *Psophocarpus tetragonolobus.*

winged bean. For this, various morphological parameters of pod and seed, percentage of germination and polyembryony have been studied.

The dried pods were collected from the northern (Puthoorvayal, Wayanad, 11°35′9.3588″N, 76°6′2.9736″E), middle (Olanad, Ernakulam, 10°05′07.21″N, 76°16′00.85″E) and southern parts (Karyavattom, Thiruvananthapuram, 8°34′26″N, 76°53′45″E) of Kerala. The experiment was conducted at the Department of Botany, University of Kerala, Thiruvananthapuram. Length, breadth and weight of the pods and seeds were measured and recorded (Table 1). The weight of 25 seeds from each accession was calculated using electronic balance. The seeds were washed thoroughly with distilled water. Three seeds were planted in each pot (3 litres) containing sand, cow dung and dried leaves, and grown under greenhouse conditions (30° ± 2°C during the day and 25° ± 2°C at night, with relative humidity near 50%). Seed germination process was observed directly at every 24 h. Observations were made for two weeks. Total number of seeds germinated and number of seeds showing multiple seedlings were recorded.

Germination percentage was maximum (100) in PT-OLD while the other two accessions showed nearly 50% germination. Polyembryony was noted in all three accessions. Out of the total germinated seeds, 62% of polyembryony was noted in PT-WYD, whereas PT-KTM and PT-OLD showed 36% and 27% respectively. Polyembryonic seeds produced two or three seedlings per seed (Figure 1). The present study reveals that seed size and germination performance influence the occurrence of polyembryony. PT-OLD showed faster germination compared to the other. In this accession 73% of seeds produced one seedling per seed and all the seedlings showed healthy growth. High rate of polyembryony in PT-WYD suggests that seed size also enhances multiple seedling emergence.

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