

observed deleterious effects of radiation on the germination and early seedling growth of chickpeas.

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The Anatomical Structure of Desi and Kabuli Chickpea Seed Coats

In grain legumes, the nature and content of seed coats are important determinants of nutritive value, milling quality, and consumer acceptability. In chickpeas, desi and kabuli seeds differ mainly in their seed coat and crude fiber contents. The thicknesses of seed coats of desi types are approximately thrice those of kabulis. Antinutritional factors such as polyphenols are located mainly in seed coats. The structures of the seed coats of some grain legumes have been studied. In this report, we describe preliminary studies of the anatomy and development of the seed coats of desi and kabuli chickpeas.

Developing seeds of H-208 (desi) and No. 501 (kabuli) cultivars grown in Vertisols at ICRISSAT Center, near Hyderabad, in 1982-83 were collected at 20, 35, and 50 days after flowering. Seed-coat samples were fixed in 3% gluteraldehyde in 0.1 M sodium phosphate buffer (pH 7.2) for 6 hr, before transfer for 3-1/2 hr to 2% osium tetroxide. Dehydration was carried out in acetone, and infiltration overnight in Spurr's low viscosity epoxy resin. The samples were embedded by polymerizing the resin at 70°C for 48 hr. Sections (1.5 to 3 μ thickness) were cut using a glass knife, stained in 0.5% toluidine blue and examined under a light microscope.

The anatomical structures of the desi and kabuli seed coats are illustrated in Figure 1. Their cell arrangements are very different, arising from the differentiation of the outer integuments. In kabuli seeds, the outermost layer (epidermis) develops into a uniseriate palisade layer without thickening of the cell wall. In desi seeds, it develops into a multiseriate palisade layer which later becomes thick walled sclereids heavily stainable with toluidine blue (Fig. 1), indicating the presence of phenolic compounds contributing to seed-coat color. Like epidermal cells, the walls of subepidermal cells do not thicken in kabuli seeds, even though their size is considerably reduced. In desi seeds, these cells become thick walled as the seed matures.

Spherical and polygonal parenchymatous cells with intercellular spaces occur below

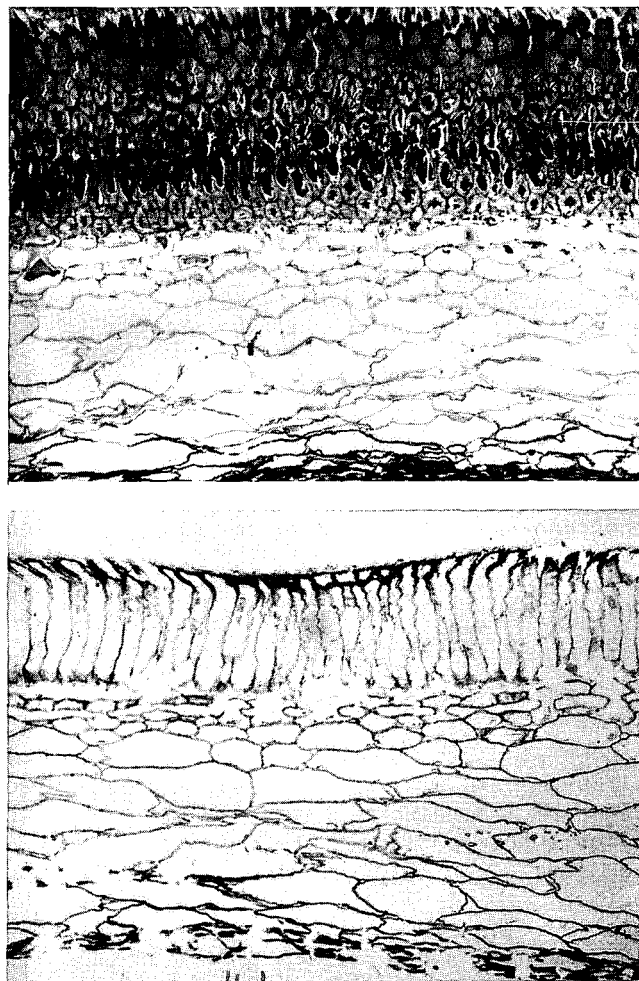


Figure 1. Cross sections of mature seed coats of desi (upper) and kabuli (lower) cultivars.

the subepidermal layer in both desi and kabuli types. During seed development, these cells become tangentially elongated especially in the outer part of the seed coat. In the early stages, the parenchymatous cells contain starch granules which disappear in the course of development probably due to their mobilization into the cotyledons. The palisade layers of seed

coats are generally associated with permeability and germinability of seeds, which may therefore be considerably influenced by the observed differences in the structure of the palisade layers of the seed coats of desi and kabuli types.

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RECIPES

Tis'ieh

- Chickpeas with Bread and Yoghurt (A Middle-eastern dish)

Ingredients

Dried chickpeas	1 cup
Bread	8 ozs. (100 g) or about 3 small rolls
Yoghurt	2 cups
Garlic	4-6 cloves
Lemon	1
Salt	To taste
Pine nuts	1 oz.
Red pepper powder	To taste
Ghee (clarified butter) or butter	
Pomegranate seeds	if desired
Chopped parsley	
Olive oil or Salad oil	

look like large croutons. Drain on kitchen paper to remove excess oil.

When dry place the fried bread in a large flat serving dish, spoon on the cooked chickpeas and a little of the cooking water to cover the bottom of the dish. Mix the yoghurt with the remaining 2-3 cloves of crushed garlic and a little more the chickpea cooking water. Spoon the yoghurt over the bread and chickpeas.

Fry the pine nuts in a little ghee or butter until golden. Take off heat and add a little sweet red pepper powder (for color) and pour over the tis'ieh to garnish. If desired, a little chopped parsley and pomegranate seeds could also be used to garnish, serve immediately. The dish could also be prepared previously and assembled when ready to serve.

Variations: Instead of frying the bread - 'Arbic' or 'Pita' bread can be used - this could be crisped in the oven prior to use. Some add chopped mint to the yoghurt mixture.

Lorna Hawtin

Procedure

Garnish pine nuts, red pepper powder, ghee (or butter), pomegranate seeds (if desired), and chopped parsley. Clean chickpeas and soak them overnight in water. The following day, cook the chickpeas in plenty of water until tender (about one hour), take off heat and add to the water the juice of one lemon and 2-3 cloves of crushed garlic and salt to taste.

Meanwhile, chop the bread into large cubes and fry in olive oil or salad oil until they

Chickpea Flour Barfi (Besan Barfi) (Indian Recipe: serves four persons)

Ingredients

Chickpea flour	1 tea cup
Sugar	1 tea cup
Water for syrup	$\frac{1}{2}$ tea cup
Oil (Ghee)	$\frac{1}{2}$ tea cup
Chopped nuts	$\frac{1}{2}$ tea cup
Cardamom seeds (crushed)	$\frac{1}{2}$ tea spoon