# Pathology

## Pigeonpea Sterility Mosaic Disease: An Emerging Problem in Northern Karnataka, India

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In Karnataka, India pigeonpea (*Cajanus cajan*) is currently grown on 0.49 million ha with a production of 0.26 million t. Gulbarga, Bidar, Bijapur, Raichur and Koppal districts in the northern region contribute to 82% of the total pigeonpea production in Karnataka. This region is popularly known as the pigeonpea bowl. Pigeonpea is cultivated as a rainfed sole crop or intercropped with pearl millet (*Pennisetum glaucum*), sorghum (*Sorghum bicolor*), sesame (*Sesamum indicum*), black gram (*Vigna mungo*), mung bean (*Vigna radiata*) and soybean (*Glycine max*). It is grown for grain, which is sold in local markets for cash. Several dhal (dehulled pigeonpea seed) mills are located in this region for dehulling and processed seed is exported to other parts of India.

A shift towards extensive pigeonpea cultivation in this region started over 40 years ago. Earlier, cotton (*Gossypium* sp) and groundnut (*Arachis hypogaea*) were the major crops. Due to erratic rainfall and the scarcity of water for irrigation, yields of these crops were reduced significantly. Under similar conditions, pigeonpea, cultivated then as a minor crop, thrived; consequently, its cropping area gradually increased. Presently, it occupies a major part of the agricultural land in this region and is the chief income source contributing to the livelihoods of farmers. However, pigeonpea production in this region is not stable due to fusarium wilt and pod borer (*Helicoverpa armigera*). In addition, sterility mosaic disease (SMD), once a minor or non-existent problem on pigeonpea in these regions, is emerging into a major problem (Narayana et al. 2000). The disease is caused by the pigeonpea sterility mosaic virus (PPSMV) transmitted by the eriophyid mite *Aceria cajani*.

A few decades ago, high-yielding pigeonpea varieties GS-1 and PT-221 were popularly grown. But these varieties were highly susceptible to wilt and threatened the future of pigeonpea cultivation in these regions. The University of Agricultural Sciences (UAS), Dharwad, Karnataka released the pigeonpea variety ICP 8863 as Maruti in 1986. This variety is highly resistant to fusarium wilt and was selected from germplasm of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. Because of its resistance to wilt and high yield potential, Maruti has become popular among farmers. Presently this variety occupies about 70% of the total pigeonpea cropping area in northern Karnataka (Bantilan and Joshi 1996). However, Maruti is highly susceptible to SMD. During initial years of cultivation, SMD appeared in traces in some areas in Bidar district, bordering Maharastra state. The disease incidence increased in this region following a major SMD epidemic in 1990 in the adjoining Marathwada region of Maharashtra (Zote et al. 1997). Because of the extensive

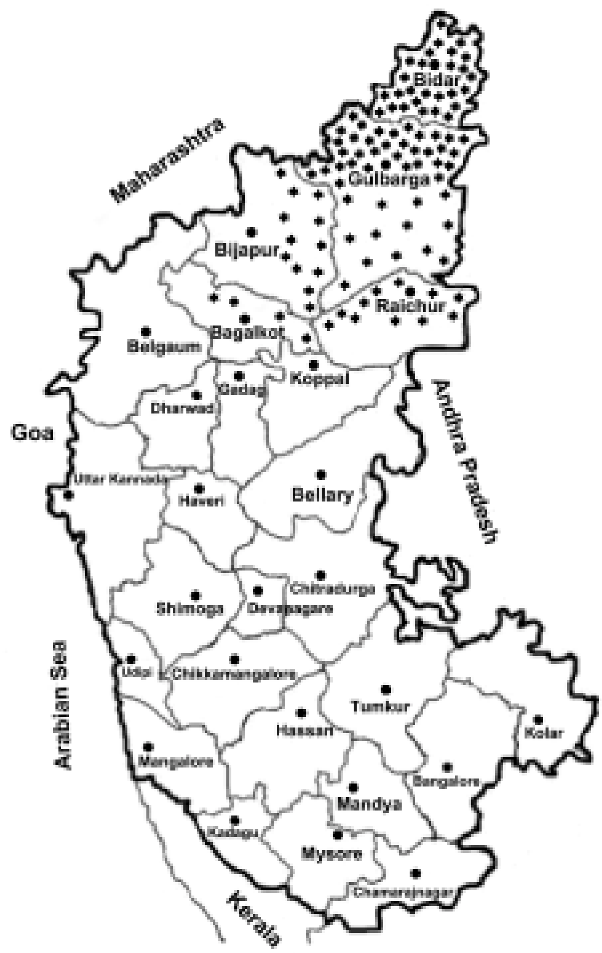


**Figure 1.** Sterility mosaic disease-endemic areas (*) in northern Karnataka, India.

and continuous cultivation of Maruti as sole crop over larger area, SMD from these minor patches spread over to wider regions in Bidar and Gulbarga, and began to spread to other pigeonpea-growing regions in northern Karnataka (Fig. 1). Since then, increased SMD incidence was reported year after year in these regions (Table 1). Surveys during the *kharif* (rainy) season in 1997 indicated severe incidence of SMD in Bidar and in few taluks of Gulbarga district (Narayana et al. 2000). During the past 8 years, 30–60% SMD incidence was recorded in several farmers' fields and in some farms 100% incidence was recorded (Officers of Karnataka State Department of Agriculture, personal communication).

One of the reasons for increased epidemics of SMD in recent years could be due to the continuous cultivation of SMD-susceptible varieties over large areas, as a sole crop year after year in the same fields. The practice of leaving stubble (30–60 cm height above ground surface) after harvesting the crop in the field allows new flushes of growth, especially in plants under the shade of sugarcane (*Saccharum officinarum*) fields and near irrigation channels. Such plants support mite multiplication and serve as volunteer inoculum sources for new pigeonpea crop sown the following season. Moreover, SMD-affected plants attract little attention from farmers, as the plants show normal vegetative growth pattern. Only at the time of flowering do farmers realize that the crop fails to produce any flowers. There were several incidents of farmers resorting to chemical sprays to induce flowering. Where partial or late infections occur, plants produce some flowers but the seed from such plants is shriveled, poor in quality and fetches a low price. About 20% (worth over US$11 million per annum) of the gross pigeonpea production in this area is lost due to SMD.

Attempts are being made to develop high-yielding varieties possessing resistance to both SMD and wilt. In 2000, an ICRISAT-bred pigeonpea variety ICPL 87119 was released as Asha for cultivation in these areas. Asha is resistant to wilt and the SMD strain prevalent in northern Karnataka, but it is late in maturity (190–200 days). Hence, the crop is predisposed to terminal drought and increased pod borer attacks. Despite this, the variety is recommended for cultivation with appropriate crop management practices in SMD-endemic zones. Training programs are being organized to educate farmers in integrated management of wilt, SMD and pod borer. The development of multiple disease resistant pigeonpea varieties, with a maturity period of 160–170 days is required for this region.

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**Table 1. Pigeonpea sterility mosaic disease (SMD) incidence in northern districts of Karnataka, India during 2000/01 and 2001/02[1].**

| | | SMD incidence (%) | | |
|---|---|---|---|---|
| District/Taluk | Area surveyed (ha) | 2000/01 | 2000/02 | Mean |
| **Gulbarga** | | | | |
| Gulbarga | 766 | 20.5 | 24.2 | 22.35 |
| Aland | 322 | 12.0 | 40.9 | 26.45 |
| Chincholi | 161 | 48.0 | 58.2 | 53.10 |
| Afzalpur | 129 | 12.0 | 14.1 | 13.05 |
| Mean | 344.5 | 23.12 | 34.35 | 28.73 |
| **Bidar** | | | | |
| Humnabad | 242 | 42.0 | 53.2 | 47.60 |
| Bhalki | 161 | 48.0 | 56.5 | 52.25 |
| Bidar | 262 | 52.2 | 60.3 | 56.25 |
| Basavakalyan | 153 | 40.3 | 42.3 | 41.30 |
| Mean | 204.5 | 45.6 | 53.0 | 49.35 |

1. SMD incidence was based on symptoms. Random samples were tested for PPSMV by double antibody sandwich ELISA as described by Kumar et al. (2002) (data not shown). Nearly 80% of the surveyed field contained the variety Maruti; rest were local varieties (cultivar information unknown).

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# Utilization

## Utilization of Pigeonpea Seeds as Protein Supplement in Chicken Ration

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Feeds are often the single largest operating cost item in broiler production and about 75% of the business budget is allocated to feed supply. Reducing such costs would mean greater income and savings to producers.

The requirement of protein in animal feed cannot be met with the present status of soybean (*Glycine max*) production in the Philippines (Bureau of Agricultural Statistics 1996). In concentrate diets, the main source of protein is soybean, which has to be imported. This situation drains the country's economy. Therefore, the country is aiming to meet its protein requirement in animal diets from indigenous crops such as pigeonpea (*Cajanus Cajan*).

In the Philippines, pigeonpea is a well adapted crop in marginal areas and the seed contains on an average 20.5% crude protein and 5.0% crude fiber (Bureau of Plant Industry 1996). This can be included safely in broiler chicken diets at a level up to 30% with no significant depression in live weight gains (Nambi and Gomex 1983). The low levels of cystine, tryptophan and phenyl alanine restrict inclusion at higher levels (Springhall et al. 1974, Wallis et al. 1986). However, this problem can be overcome by including other legumes that are rich in cystine and tryptophan. To utilize pigeonpea which is very well adapted in the region, a research study was conducted to determine the most acceptable level of pigeonpea seeds to be mixed with the pure commercial feeds for broilers.

Ninety-six 2-week-old broiler chicks were studied in a randomized complete block design with four levels of pigeopea seed meal (PSM) and pure commercial mash (PCM) as treatments. The levels (PSM:PCM) were $T_1$ – 0:100, $T_2$ – 15:85, $T_3$ – 30:70 and $T_4$ – 45:55. Each treatment had eight birds and was replicated three times. The birds were fed ad libitum with the mixed ration and the feeding period was for 4 weeks from 5 December 1995 to 2 January 1996.

Protein content was slightly lower in the test rations supplemented with PSM when compared to PCM. The total crude protein was 21% in $T_1$, 20.4% in $T_2$, 20% in $T_3$ and 19.6% in $T_4$ (Table 1). Total gain and daily gain in body weight of the bird differed significantly ($P$<0.05) in