Pulses

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24.1 Pigeon Pea

24.1.1 Species

Mealybugs are found to infest pigeon pea (red gram) (*Cajanus cajan*) in India, Trinidad, Africa and Ghana (Table 24.1). Several scale insects have been misquoted as mealybugs of pigeon pea in India (Bhatnagar et al. 1984; Shaw et al. 1999; Singh 2004).

24.1.2 Bionomics

Mode of reproduction of *Planococcus cajani* is sexual and oviparous. Incubation period of eggs is 5.2 days. The female and male nymphs moult thrice and four times, respectively, in 18.41 and 16.26 days at 28.1–29.9 °C and 84–93 % relative humidity (RH). *Coccidohystrix insolita* caused damage to pigeon pea in Gujarat and Tamil Nadu, India. The eggs were off-white, oval and found within the protective cottony ovisac. The male and female bugs passed through four and three nymphal instars, respectively. It takes 42.14 and 59.49 days for males and females at the field temperature of 24.94 ± 2.27 °C with 70.11 ± 13.10 % relative humidity, respectively. The sex ratio of male to female was 2.07 in the field (Borad and Bhalani 1997). *Coccidohystrix insolita* attained major pest status in pigeon pea with the introduction of new varieties and necessitating management practices (Ganapathy et al. 1994). The mealybug was found infesting leaves, flowers and pods. The mealybug was found more devastating in Vamban, Tamil Nadu, India.

The damage caused by *Coccidohystrix insolita* was characterised by the presence of large congregation of nymphs and adults with their body covered with white mealy coating on the under surface of the leaf. The affected leaflets turn yellow and drop off. The plant becomes stunted initially. Severe incidence causes wilting and drying of plants. The movement of ants and development of sooty mould were observed on the mealybug-infested plants (Durairaj and Ganapathy 2000). *Maconellicoccus hirsutus* has been reported to cause 15 % plant infestation on pigeon pea in Gujarat, India.

Mealybug crawlers were observed on the lower surface of leaves, causing damage by sucking the cell sap. In severe infestation, the pest was found covering the whole leaf surface. Severely affected plants were stunted. Honeydew excreted by nymphs and adults supported the growth of sooty moulds on leaves and shoots, giving blackish appearance to leaves (Patel et al.

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Table 24.1 List of mealybugs recorded on pigeon pea

Mealybug Species	Country/Region	References
Coccidohystrix insolita (Green) (*Centrococcus insolitus* (Green))	India	Nair (1975), Atwal (1976)
	Gujarat, India	Patil et al. (1985), Rai et al. (1988)
	Tamil Nadu, India	Durairaj and Ganapathy (2000)
Dysmicoccus brevipes (Cockerell)	India	Rajagopal et al. (1982)
Ferrisia virgata (Cockerell)	Haryana, India	Gautam and Saxena (1986)
Paracoccus marginatus Williams and Granara de Willink	Ghana	Cham et al. (2011), Shylesha et al.(2011)
	Karnataka, India	Tanwar et al. (2007)
Maconellicoccus hirsutus (Green)	Gujarat	Patel et al. (1990), Rajadurai and Thyagarajan (2003), Persad and Khan (2006)
Nipaecoccus viridis (Newstead)	–	Ben-Dov (1994)
Nipaecoccus filamentosus (Cockerell) Syn: *Pseudococcus filamentosus* Cockerell	India	Nair (1975)
Phenacoccus madeirensis Green	–	Ben-Dov (1994)
Phenacoccus solenopsis Tinsley	India	–
Planococcus cajani Mukherjee and Mukhopadhyay	India	Mukhopadhyay and Mukherjee (2005)
Planococcus minor (Maskell)	Trinidad	Francis et al. (2012)
Planococcus kenyae (LePelley)	Africa	http://www.infonet-biovision.org/default/ct/94/pests
Rastrococcus iceryoides (Green)	India	Williams (2004)

1990). *Paracoccus marginatus* was reported to cause 25 % damage to pigeon pea in Tamil Nadu. In Haryana, nymphs and adults of the mealybug *Ferrisia virgata* were found mainly on the inflorescences, causing withering and dropping of flowers. On heavily infested plants, the population of *F. virgata* ranged from 1 to 2/leaf, 2 to 3/flower and 10 to 13/inflorescence (Gautam and Saxena 1986). In Bangalore, India, *Dysmicoccus brevipes* was found infesting the root nodules of red gram in southern India There were two to three mealybugs per nodule. All stages of the mealybug were observed, and infestation was noted at the depth of up to 22 cm. More than 80 % of the plants were infested. The ant *Monomorium* sp. was found to be attracted to sites of mealybug infestation (Rajagopal et al. 1982) (Fig. 24.1).

24.2 Chickpea

Ferrisia virgata was found damaging chickpea *Cicer arietinum* by sucking the sap of the leaves.

24.3 Mung Bean

Geococcus coffeae Green was found sucking the leaves, stem and pods of mung bean (green gram) (*Vigna radiata*) (Kooner 2006). Root mealybugs *D. brevipes* and *Geococcus coffeae* have been reported to cause damage to green gram in India.

24.4 Cowpea

Dysmicoccus brevipes (David and Ananthakrishnan 2004), *Maconellicoccus hirsutus* (Persad and Khan 2006) and *Geococcus* spp. (Mathew et al. 2011) are known to infest cowpea (*Vigna unguiculata*) in India.

24.5 Beans

Paracoccus maraginatus was found infesting beans (*Phaseolus vulgaris*) in Ghana (Cham et al. 2011), Florida (Walker et al. 2003), Sri Lanka (Galanihe et al. 2010), Palau (Muniappan et al. 2006) and Hawaii (Ronald et al. 2007).

Fig. 24.1 Mealybug damage to pigeon pea: (**a**) *P. solenopsis* on pigeon pea, (**b**) *P. marginatus* on pigeon pea and (c) *P. maraginatus* on *Phaseolus vulgaris*

24.6 Blackgram

Dysmicoccus brevipes was known to infest black gram (*Vigna mungo*) in India (David and Ananthakrishnan 2004).

24.7 Management

24.7.1 Chemical Control

Monocrotophos (0.04 %) + kerosene oil (0.05 %) + soap (0.02 %) and ethion were found to be highly effective in controlling *Coccidohystrix insolita* in pigeon pea in South Gujarat (Rai et al. 1988). More than 95 % reduction in field population of *C. insolita* was observed with applications of lambda-cyhalothrin, dichlorvos and profenophos in Tamil Nadu (Durairaj and Ganapathy 2000). Methyl parathion (0.03 %), quinalphos (0.05 %), monocrotophos (0.04 %), cypermethrin (0.009 %), endosulfan (0.075 %), diazinon (0.05 %), chlorpyrifos (0.05 %) and decamethrin [deltamethrin] (0.00125 %) caused 89.2, 88.1, 68.0, 33.9, 32.1, 30.5, 30.0 and 7.9 % mortality of *C. insolita*, respectively, on the treated leaves (Patel et al. 1989).

24.7.2 Biological Control

There are many parasitic wasps and various predatory insects that feed on mealybugs. *Cryptolaemus montrouzieri* can be used to control the mealybugs in general. Host-specific parasitoids are available for the control of mealybugs. For example, *Acerophagus papayae* Noyes and Schauff for *P. marginatus* can be used to control the *P. marginatus*.

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