

SCORING FOR PESTS, DISEASES AND RODENTS IN SELECTED ACCESSIONS OF COCOA (*THEOBROMA CACAO L.*)

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Cocoa (*Theobroma cacao* L.) belonging to the family Malvaceae (Alverson *et al.*, 1999), is the third important beverage crop next to coffee and tea grown all around the world for the delicious chocolates. It is indigenous to the tropical humid forests on the lower eastern equatorial slopes of the Andes in South America (Ammu, 2010). It was domesticated by the natives of Central America and was considered to be of divine origin. The generic name *Theobroma* literary means "Food of Gods".

Cocoa is affected by a range of pests, diseases and rodents, with some estimates putting losses as high as 30% to 40% of global production. Host resistance is recommended as the best option for the economic and sustainable control. This article provides information on the accessions showing resistance to major pests, diseases and rodents affecting the pods of cocoa, which can serve as donor parents in resistance breeding programmes.

Materials and methods

Fifty clonal accessions of cocoa comprising of 40 exotic and 10 indigenous ones selected from the germplasm maintained by Cocoa Research Centre, Vellanikkara, formed the material for the study. The selected accessions laid out in RBD with three replications have already reached the steady bearing stage. The details of these accessions are presented in Table 1.

A preliminary scoring of all the selected accessions was done for their susceptibility to pests, diseases and rodents (rats and squirrels). Every month ten pods were selected at random from each accession and any infestation if present was recorded. This was continued for one year and the results were expressed as percentage of the total number of pods observed (Table 1).

Results and discussion

Mealy bug and tea mosquito bug were the major pests and black pod was the major disease

affecting the pods resulting in yield loss. Besides, rodents like rats and squirrels also caused damage to the pods. The percentage of infestation by each pest, disease and rodent are presented in Table 1.

Among the accessions evaluated eleven accessions *viz.*, PINA, B7 B2, PA 56, KER 2E, SCA 6, B7 A6, EQX-3348-44, IMC 54, Konni local 1, 2, 4 and Thodupuzha local 3 were seen infected by mealy bug (Table 1) (Plate 1). The percentage of infection was more in Konni local 2 (22.5%) followed by SCA 6 (20%).

Tea mosquito bugs are serious pests of cocoa worldwide causing a yield loss as high as 75 percent. The exotic accessions COCA 3370-3, BE 3, PINA, DOM 4, R (10) (MEX), B7 B4, UF 677, B5-7, GDL 3, CLM 90, DOM 25, R (39) (MEX), GU 310, EET 400, IMC 16, EET 397, IMC 67, PA 137, IMC 54, SPEC 160-9, Criollo and indigenous accessions except Konni local 4 and 5 and Thodupuzha local 3 were found to be free from tea mosquito attack (Table 1). The highest percentage of tea mosquito attack was observed in the accession ICS 95 (52.5%) (Plate 2). The estimates of crop loss due to *Helopeltis* (tea mosquito) are variable and depend upon factors such as agricultural practices, control methods, locality, climate and the varieties and insect species involved (Alagar and Subaharan, 2011).

Black pod (pod rot) caused by *Phytophthora palmivora* was the major disease affecting almost all the selected accessions. Black pod disease was first noticed in Guyana and West Indies and referred as black cocoa. It was reported for the first time from India in 1965. *Phytophthora palmivora* has been found to be the causal organism of this disease. At present it is prevalent in all cocoa growing countries. The highest percentage of infection was observed on the accession AMAZ 10-1 (97.5%) (Plate 3). The incidence of black pod was absent in COCA 3370-3, BE 3, R (10) (MEX), B5-7, DOM 25 and

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Thodupuzha local 3. Lawrence (1978) screened fifty-one cultivars for *P. palmivora* resistance and found that SCA 6 had promising degree of resistance. However, in the present study SCA 6 showed a percentage infestation of 32.5.

Rodents are the major pests of cocoa in almost all cocoa growing countries of the world. Among them the black rat (*Rattus rattus*), the Western Ghats squirrel (*Funambulus tristriatus*) and the South Indian palm squirrel (*F. palmarum*) are considered to be the major ones (Bhat, 1978). Together they are reported to cause 29 to 52 percent damage to the standing crop in different areas of South India (Bhat, 1978). Abraham *et al.*, 1979, suggested that timely harvest of mature pods could reduce the squirrel damage in cocoa. He also noticed that covering the cocoa pods with gunny bags or polythene covers smeared with bitumen was very effective in reducing squirrel damage.

In this study, majority of accessions evaluated were susceptible to rat attack. The accession EET 400 showed the highest susceptibility (72.5%) to damage by rats. The two indigenous accessions, Calicut local 1 and 2 were free from rat attack. Squirrel attack was limited to accessions PINA, B7 B2, PA 56, DOM 4, KER 2E, R (10) (MEX), UF 677, B7 B4, GDL 3, B5-7, MAR 9, B7 B5, GU 310, EET 400, RB 33/3, SPEC 160-9, EQX-3348-44, IMC 54. All the indigenous accessions were observed to be resistant to squirrel attack. Bhat (1980) suggested that Indian squirrels (*Funambulus* spp.) tend to make oval holes centrally or terminally (Plate 4) and rats (*Rattus rattus*) make round holes near the stalk portion (Plate 5). In the present investigation more damage was caused by rats than squirrels.

In addition to these pests, disease and rodents, caterpillar attack was also observed in a few of the accessions *viz.*, AMAZ 10-1, PINA, KER 2E, B7 B4, CLM 90, Calicut local 1, Konni local 4. This was identified as the caterpillar (cocoa bollworm) of green moth, *Earias biplaga*, and was found to devour the pericarp of unripe pods of cocoa (Plate 6). The accession CLM 90 was the most susceptible one (Table 1).

Conclusion

The accessions varied in their susceptibility to pests, diseases and rodents. Among the accessions evaluated COCA 3370-3 was found to be tolerant to the major pests, diseases and rodents affecting the pods of cocoa. This may be due to the high husk thickness (ridge thickness = 1.97cm; furrow thickness = 1.78cm) of this accession. Hence the exotic accession, COCO 3370-3 can serve as a donor parent in resistance breeding programmes.

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References

- Abraham, C.C., Nair, T.V.R., and Chandrasekhar, P.R. 1979. The nature and extent of damage to cocoa pods caused by the striped squirrel *Funambulus tristriatus tristriatus* Wroughton (Rodentia: Sciuridae) and the relative efficiency of different management methods. In: Bhavappa, K.V.A. (ed.), *Proceedings of PLACROSYM II*. Central Plantation Crops Research Institute, Kasaragod, pp. 62-67.
- Alverson, W.S., Whitlock, B.A., Nyfeller, R., Bayer, C., and Baum, D.A. 1999. Phylogeny of the core Malvales: Evidence from ndhF sequence data. *Am. J. Bot.* 86: 1474-1486.
- Amma, S.P. 2010. Three decades of cocoa research in Kerala Agricultural University, Thrissur. *Cashew Cocoa J.* 2(2): 15-19.
- Alagar, M. and Subaharan, K. 2011. Management of tea mosquito bug for enhancing the productivity of cocoa. In: Apshara, E.S., Jaganathan, D., and Balasimha, D. (eds.), *Proceedings of Seminar on Strategies for Enhancing Productivity of Cocoa*. Central Plantation Crops Research Institute, Vittal, pp. 128-134.
- Bhat, S.K. 1978. Rodent damage to cocoa in South India. *Rodent Newsl.* 2(3): 1.
- Bhat, S.K. 1980. Studies on rodent damage to cocoa in South India: identification off their damage. *Planter* 56: 101-104.
- Lawrence, J.S. 1978. Screening of cocoa cultivars for resistance to *Phytophthora palmivora* in the collection at CATIE. *Rev. Theobroma* 8: 25-31.

Table 1. Percentage of infestation

Accessions	Mealy bug(%)	Tea mosquito bug(%)	Black pod(%)	Squirrel (%)	Rat (%)	Caterpillar (%)
SC 10	-	30	25	-	-	-
COCA 3370-3	-	-	-	-	-	-
AMAZ 10-1	-	15	97.5	-	60	2.5
BE 3	-	-	-	-	2.5	-
AMAZ 15	-	25	35	-	7.5	-
AMAZ 6-3	-	7.5	17.5	-	15	-
AMAZ 3-2	-	2.5	50	-	7.5	-
PINA	5	-	95	2.5	2.5	2.5
B7 B2	2.5	7.5	57.5	10	65	-
PA 56	5	10	40	5	35	-
DOM 4	-	-	10	25	50	-
KER 2E	12.5	22.5	65	2.5	17.5	12.5
R (10) (MEX)	-	-	-	10	2.5	-
B7 B4	-	-	12.5	10	42.5	5
UF 677	-	-	2.5	2.5	55	-
GDL 3	-	-	5	12.5	22.5	-
B5-7	-	-	-	2.5	5	-
MAR 9	-	7.5	10	10	5	-
CLM 90	-	-	12.5	-	15	17.5
R (39) (MEX)	-	-	12.5	-	-	-
B7 B5	-	25	47.5	2.5	15	-
DOM 25	-	-	-	-	2.5	-
KER 9	-	7.5	30	-	20	-
LV 28	-	5	2.5	-	-	-
B7 A6	5	50	7	-	-	-
GU 310	-	-	25	7.5	25	-
EET 400	-	-	25	7.5	72.5	-
IMC 16	-	-	30	-	2.5	-
EET 397	-	-	10	-	7.5	-
ICS 95	-	52.5	10	-	7.5	-

Accessions	Mealy bug(%)	Tea mosquito bug(%)	Black pod(%)	Squirrel (%)	Rat (%)	Caterpillar (%)
IMC 67	-	-	15	-	37.5	-
SCA 6	20	7.5	32.5	-	37.5	-
PA 137	-	-	12.5	-	17.5	-
RB 33/3	-	2.5	22.5	2.5	10	-
SPEC 160-9	-	-	22.5	5	25	-
EQX-3348-44	2.5	5	22.5	5	7.5	-
PUCALA 1	-	7.5	20	-	27.5	-
IMC 54	5	-	12.5	10	12.5	-
IMC 14	-	5	25	-	12.5	-
Criollo	-	-	22.5	-	12.5	-
Calicut local 1	-	-	12.5	-	-	2.5
Calicut local 2	-	-	2.5	-	-	-
Konni local 1	2.5	-	35	-	32.5	-
Konni local 2	22.5	-	42.5	-	7.5	-
Konni local 3	-	-	42.5	-	15	-
Konni local 4	5	5	27.5	-	5	2.5
Konni local 5	-	10	25	-	52.5	-
Thodupuzha local 1	-	-	72.5	-	2.5	-
Thodupuzha local 2	-	-	57.5	-	15	-
Thodupuzha local 3	5	12.5	-	-	30	-

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Plate 1. Mealy bug attack



Plate 2. Tea mosquito bug attack



Plate 3. Black pod



Plate 6. Caterpillar attack



Plate 4. Squirrel attack

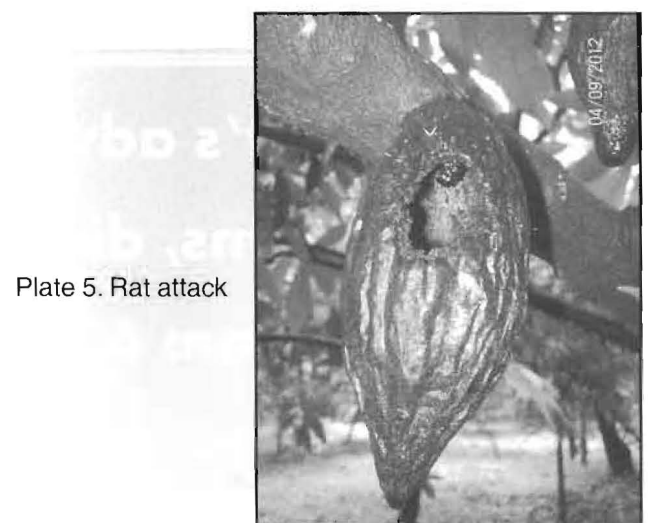


Plate 5. Rat attack