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Research Application Summary

Collection and documentation of Papaya germplasm in Kenya

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Abstract

Papaya (*Carica papaya* L.) is one of the major fruit crops of Kenya and the tropics in general. It shows considerable phenotypic variation in morphological and horticultural traits that can be utilized in genetic improvement. The objective of this research was to collect and document papaya germplasm in Kenyan. A survey was conducted in 6 major papaya producing provinces of Kenya, namely, Coast, Nyanza, Western, Rift Valley, Eastern and Central, using a structured questionnaire supplemented by oral interviews. The survey was carried out between June and September 2008. A total of 65 accessions were collected from the six provinces. A number of accessions were identified by small scale farmers only in their ethnic languages such as 'local', 'papayi' and 'apoyo'. Some cultivars that had been reported earlier could not be traced in the provinces, because of the impossibility of maintaining open pollinated cultivars of papaya by local resource poor farmers. Thus, there is need for documenting papaya germplasm as this provides conservationists and breeders with relevant and up to date information for their purposes.

Key words: Accession, *Carica papaya* L., genetic diversity, *Vasconcellea cundinamarcensis*

Résumé

La papaye (*Carica papaya* L.) est l'une des principales cultures fruitières du Kenya en particulier et des tropiques en général. Elle montre une importante variation phénotypique des caractères morphologiques et horticoles qui peuvent être utilisés dans l'amélioration génétique. L'objectif de cette recherche était de rassembler et de documenter le matériel génétique de la papaye dans kenyane. Une enquête a été menée dans 6 grandes provinces productrices de papaye du Kenya, à savoir, la côte, Nyanza, l'Ouest, le Rift Valley, les provinces orientale et centrale, en utilisant un questionnaire structuré complété par des entretiens oraux. L'enquête a été réalisée entre Juin et

Septembre 2008. Un total de 65 accessions ont été collectées à partir des six provinces. Un certain nombre d'accessions n'ont été identifiées par des petits agriculteurs que dans leurs langues ethniques, telles que 'local', 'papayi » et « Apoyo. Certains cultivars qui avaient été rapportés précédemment ne pourraient pas être retrouvés dans les provinces, en raison de l'impossibilité de maintenir ouverts les cultivars à pollinisation de papaye par des agriculteurs locaux pauvres en ressources. Ainsi, il est nécessaire de documenter le matériel génétique de la papaye car il peut fournir aux écologistes et aux éleveurs des informations mises à jour et importantes à leurs fins.

Mots clés: accession, *Carica papaya* L., diversité génétique, *Vasconcellea cundinamarcensis*

Background

Papaya (*Carica papaya* L.) is a major fruit crop of Kenya and is believed to have been introduced to the country centuries ago (HCDA, 2008). The main variety is 'Solo' from Hawaii and others that have been developed from it. Other varieties like 'Cavite', '417', '418', '455' and '457' were introduced later from Philippines, India and Indonesia, respectively (Kamau *et al.*, 1993). Since papaya is propagated sexually, a lot of changes have occurred as a result of open pollination resulting in loss of identity of the introduced cultivars. Thus, there is need for either introduction of upgraded varieties or improvement of the existing ones. The latter option is better considering the issue of local adaptability. Besides, there are also some landraces in the country that can be exploited in improvement programmes.

Kamau *et al*. (1993) evaluated 7 hybrids based on crosses between introduced and locally developed varieties for fruit yield, quality and disease resistance. They identified 3 hybrids with a high degree of resistance to black rust, high sugar content, good texture and appearance and recommended further improvement. However, no report has been published in connection with Kamau *et al*. (1993) research so far. Thus, there is need to document the existing germplasm in the country, as this will inform future improvement and conservation programmes. The objective of this study was to collect and document papaya germplasm in Kenya.

Literature Summary

Papaya belongs to the family *Caricaceae* (Nakasone and Paull, 1998). It is cultivated from sea level to about 1500m above sea level (Griesbach, 1992). Papaya has never been found wild, but, it is reported to have originated in Southern Mexico and

Costa Rica. It was taken by the Spaniards to Manila in the mid-16th century and reached Malacca shortly afterwards (Purseglove, 1968). From there it was taken to India. It was reported in Zanzibar in the 18th century and in Uganda in 1874 (Purseglove, 1968). It is widespread in all tropical and subtropical countries (Purseglove, 1968), including Kenya. It is possible that papaya moved from Uganda to Kenya through regional trade.

The closest relative of papaya is the mountain papaya (*Vasconcellea cundinamarcensis*), which is believed to be a native of Colombia and Ecuador. Incidentally, it is also found in Kenya highlands from 1500-2000m (Griesbach, 1992). The extent and distribution of the available inter- and intra- specific diversity of papaya is inadequately documented in Kenya.

Study Description

The papaya germplasm survey and collection was carried between June and September 2008. Each field surveyed was mapped by Global Positioning System (GPS) receiver (Table 1), prior to data collection to provide accurate information on

Table 1. Locations of the various farms studied during germplasm collection.

Farm names	District	Province	Latitude	Longitude	Elevation
Migingo	Kilifi	Coast	S03.91324	39.73970	12
Kilifi Institute	Kilifi	Coast	S03.92096	39.44260	37
Salehe-in	Kilifi	Coast	S03.92476	39.84260	25
Khosla farm	Kilifi	Coast	S03.90316	39.75990	12
Imani	Taita	Coast	S03.59904	38.73290	613
Voi	Taita	Coast	S03.39423	38.56310	582
Voi	Taita	Coast	S03.42621	38.55370	589
Manyani	Taita	Coast	S03.09620	38.99020	552
Marigat	Baringo	Rift Valley	N00.46673	35.99300	1025
Marigat	Baringo	Rift Valley	N00.46885	36.00450	1011
Cheptebo	Keiyo	Rift Valley	N00.47220	35.60330	1232
Sacred Training Institute	Bungoma	Western	N00.58966	34.53640	1434
Vihiga	Vihiga	Western	N00.01008	34.74950	1455
Rapogi	Rongo	Nyanza	S00.44360	34.34110	1380
Nyasaoro	Rongo	Nyanza	S00.45200	34.38170	1561
Nyakongo	Nyamira	Nyanza,	S00.59200	34.91910	2019
Molo	Nakuru	Rift Valley	S00.14206	35.44330	2425
Molo	Nakuru	Rift Valley	S00.92290	36.07100	1913
Kaunu	Tharaka	Eastern	S00.16746	37.80440	897
Kaunu	Tharaka	Eastern	S00.16739	37.80590	891
Kianamothi	Tharaka	Eastern	S00.18659	37.81490	874
Embu Training Institute	Embu	Eastern	S00.51275	37.45750	1488
Mwea	Kirinyaga	Central	S00.72724	37.42610	1124
Kibirigwe	Kirinyaga	Central	S00.53487	37.18250	1431
Kimirine	Maragwa	Central	S00.46060	37.09120	1289

the locations. The germplasm was collected from 6 major papaya producing provinces of Kenya namely, Coast (Kilifi and Taita), Nyanza (Rongo and Nyamira), Western (Bungoma, Kakamega and Vihiga,), Rift Valley (Baringo, Keiyo and Nakuru), Eastern (Tharaka and Embu), and Central (Kirinyaga and Maragua) (Table 1). Structured and semi-structured questionnaires were used to gather the information that was not obvious to the researchers. Consultation with the respective District Agricultural Officers and farmers knowledgeable with the sampled areas enabled accurate identification of the farms that were growing papaya. Descriptive statistics of the data collected from the surveys were performed using Statistical Package for the Social Sciences (SPSS), SPSS version 11.0 for windows (2001 SPSS Inc.).

Research Application

The papaya germplasm collected consisted of 65 papaya accessions (Table 2). From the survey, Kilifi district had the highest number of varieties reported, namely papayi, red-lady, sunrise and US (Table 2). Coast and Rift Valley provinces had the highest number of varieties with each province recording four of the total varieties collected. *Vasconcellea cundinamarcensis* was found in Nakuru and Nyamira districts in Rift Valley and Nyanza provinces, respectively (Table 2).

Table 2. Occurrence of accessions in the sampled districts.

District	Province	Accessions collected	No. of accessions
Kirinyaga	Central	Local, Papayi	2
Maragua	Central	Papayi	2
Taita	Coast	Papayi	17
Kilifi	Coast	Papayi, Redlady, Sunrise, US	12
Tharaka	Eastern	Local, Sunrise	8
Embu	Eastern	Sunrise	2
Rongo	Nyanza	Apoyo	8
Nyamira	Nyanza	*Vasconcellea cundinamarcensis*	1
Keiyo	Rift Valley	Honey dew, Solo	2
Baringo	Rift Valley	Kiru, Solo, Sunrise solo	4
Nakuru	Rift Valley	*Vasconcellea cundinamarcensis*	2
Bungoma	Western	Kiru	1
Vihiga	Western	Papayi	4

The most frequently recorded accessions were Papayi and Sunris. An accession locally named as ‘Papayi’ was found widely cultivated in five districts namely, Kilifi, Taita, Vihiga, Maragua, and Kirinyaga districts, while Sunrise which is a commercial cultivar was found in four districts namely Baringo, Tharaka, Embu and Kilifi districts. The least distributed accessions included Apoyo, Sunrise solo, Honey dew, Redlady

and US found only in one district each in Rongo, Baringo, Keiyo and Kilifi districts, respectively.

Recommendation

The study indicates that there is a variety of papaya germplasm in Kenya. Due to the open pollination nature of this crop the identity of a number of originally introduced germplasm has been lost, e.g. Kitale, Cavite, Malindi, PP1, 77, 116, 273, 417, 418, 455 and 457 that were earlier reported by Imungi and Wabule (1990) and Kamau *et al*. (1993). This calls for urgent measures to fix genetic variability of noble germplasm and conservation of the existing germplasm. Efficient utilization of plant germplasm as well as conservation depends on the availability of reliable genetic diversity information (Bekele *et al*., 2005).Thus, characterization of the available papaya germplasm is necessary to unravel its potential in genetic improvement of the crop.

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