Citrus Genetic Diversity in Central India

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Two exploration tours were conducted in Vidarbha, Marathwada and Western Maharashtra in the year 2000 and 2001. A total of 52 accessions belonging to mandarin, rough lemon, Rangpur lime, sweet orange and acid lime groups were collected from different parts of Maharashtra and added to National gene bank. These include improved cultivars, superior clones and different strains of rootstocks. This is observed very potential area for collection of Mandarin, Acid lime and Mosambi germplasm. Citrus genetic diversity in central India is maintained mostly by farmers as on farm conservation. This is one of the most potential areas in country for citrus cultivation where, all the three commercial citrus crops are grown.

Key Words: Citrus, Germplasm, Exploration, Rootstock, Threat

Central India is maintained mostly by farmers as on farm conservation. This is one of the most potential areas in country for citrus cultivation. In this region, all the three commercial citrus crops are grown in different pockets. Besides rough lemon, Rangpur lime, sweet lime and lemon are also grown and because of demand, are maintained by farmers on their farms. In Central India two main field gene banks have been established, one at NRCC, Nagpur and another at MPKV, Rahuri, Ahmadnagar. Besides this some good citrus genetic materials are also maintained in field gene bank of Dr. PDKV, Akola and Katol. Details of germplasm maintained in these gene banks were reported by Singh *et al.* (1999) and Pujari *et al.* (1999). In these gene banks most of the accessions were collected from different Institutions. Therefore NRCC planned exploration mission especially in these famous commercial citrus area to collect available variability.

Material and Methods

Two exploration tours were conducted in Vidarbha, Marathwada and Western Maharashtra in the year 2000 and 2001. We surveyed Balapur area of Akola, Paithan, Gangapur and Khultabad area of Aurangabad, Badnapur and Ambad area of Jalna, Rahuri and Shrigonda area of Ahmednagar and Shirur area of Pune and Amravati, Washim, Hingoli, Nanded and Beed (Figs. 1 and 2). The sites were characterized by land features from plain land of farmers field to home garden. Samples were collected in form of fruits and budsticks.

Soil and Climate

The majority soils are shallow to deep with clayey texture, full of $CaCo_3$ concentration and soil pH varying from 7.3 to 8.2 having montmorillonitic (swell when wet and shrink when dry) mineralogy. The soils range from principally black mixed with red and shallow to deep soils. Most of the rain is received in July and August with a total rainfall of 500 mm to 900 mm per year. Climatically, the area is classified as tropical, where the maximum temperature goes upto 47° C during peak summer (May) and minimum upto 7–8° C during the peak winter (December-January). Collection sites covered a wide altitudinal range from 281 m to 650 m above sea level. The sweet orange growing Marathwada region is hotter and humid compared to Nagpur mandarin growing climate of Vidarbha region of Maharashtra.

Results and Discussion

A total 52 accessions of citrus belonging to different citrus groups were collected (Table 1). Maharashtra has on top havs highest area under citrus cultivation in the country. All three commercial citrus crops (mandarin, sweet orange and acid lime) are grown here. Famous Nagpur mandarin is grown in Vidarbha region of Maharashtra and adjoining area of M.P. Most well known belt of Nagpur mandarin cultivation is the foot hill region of Satpura in central India from Jalgaon (MS) to Pandhurna (M.P.). However due to water shortage a number of orchards started drying up in Pandhurna area (MP) and Warud, Narkhed area in the year 2002 (Figs. 3 and 4). Nagpur mandarin is commercially grown in Warud, Morshi (Amravati), Katol, Narkhed, Ramtek, Umred (Nagpur), Arvi, Karnaja (Wardha), Dhigras, Darwha (Yevatmal) Achalpur-Chandur Bazar (Amravati).

Mosambi (*Citrus sinensis*) genetic diversity is also maintained by farmers in their orchards. It is commercially grown in Jalna, Aurangabad, Ahmednagar, Pune, Nanded,

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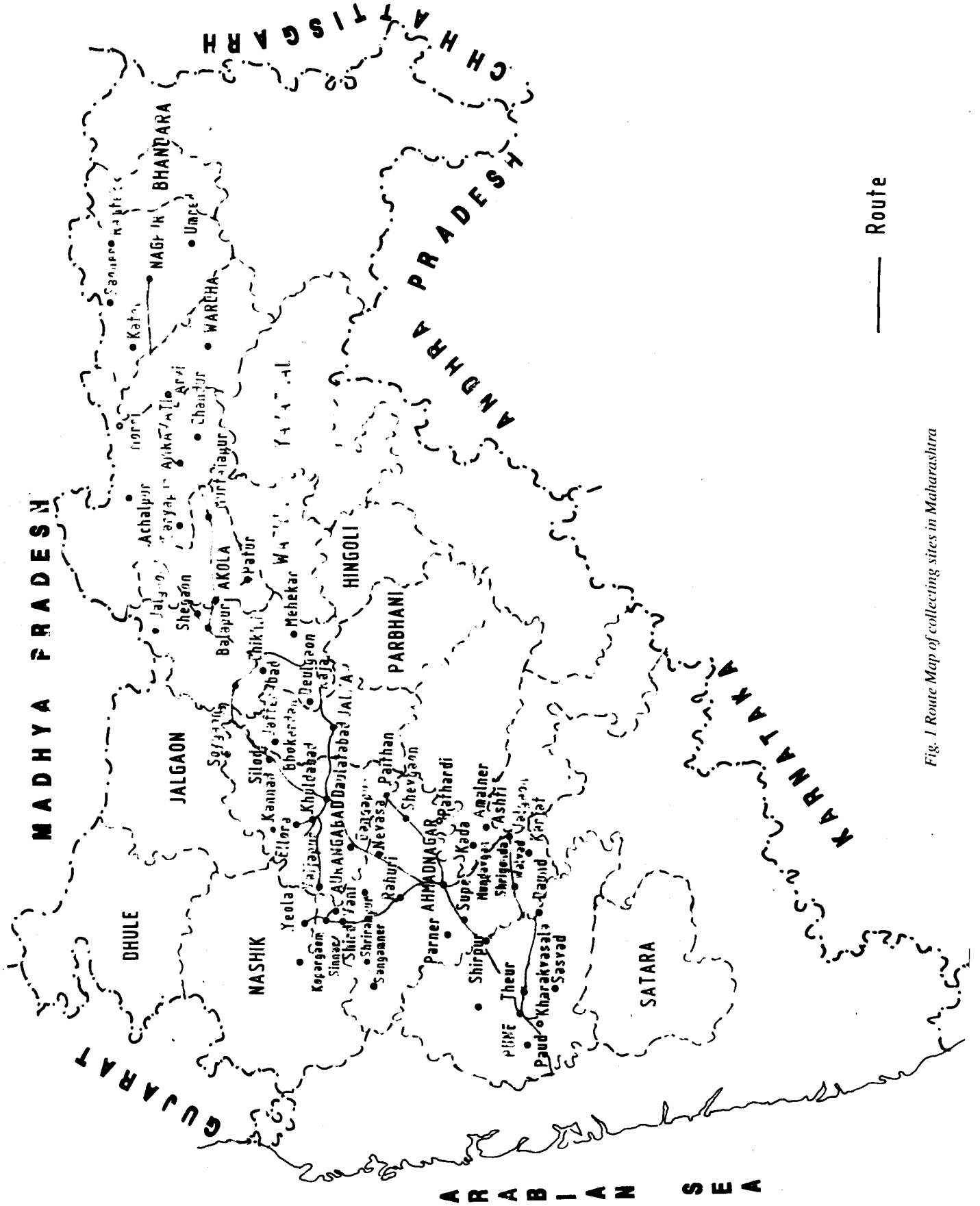

Fig. 1 Route Map of collecting sites in Maharashtra

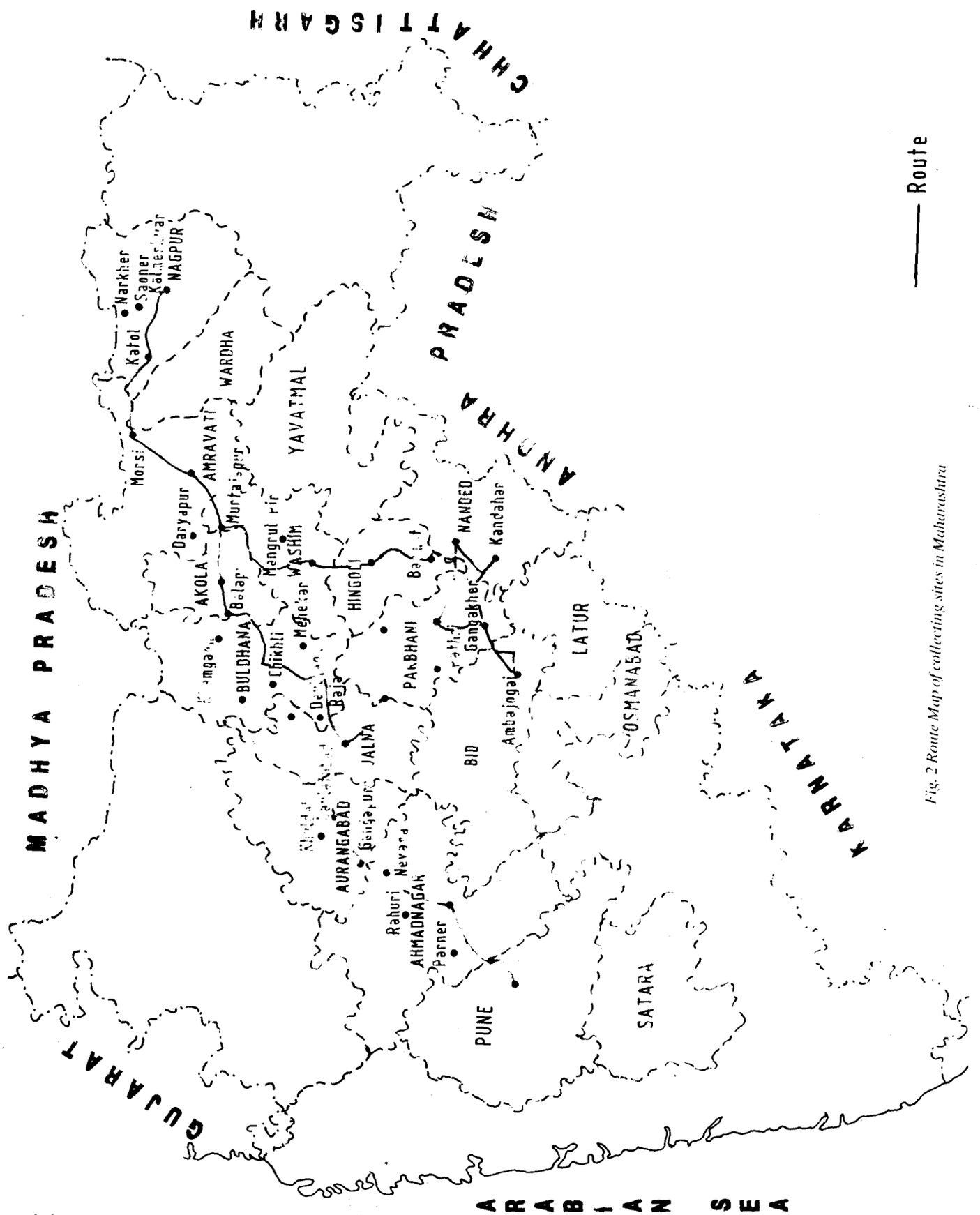

Fig. 2 Route Map of collecting sites in Maharashtra

Parbhani areas of Marathwada region of Maharashtra and is now gaining popularity in area like Narkhed, Katol, Jallalkheda, Buldhana and Yeotmal area due to mainly longer post harvest life and comparatively less problem associated regular flowering coupled with better marketing option.

Acid lime is mainly grown in Akola, Nanded, Srigonda and Parbhani areas of Maharashtra. Variability in acid lime fruit size was observed since it is propagated by seed only. Variability in Kagzi lime was observed in terms of fruit yield, size, shape and number of seeds per fruit. Similar variation in Kagzi lime strain was also reported

Table 1: List of Citrus germplasm collected during exploration in Vidarbha, Marathwada and Western Maharashtra region of Maharashtra

Sl. No.	IC-Number	Collector No.	Name of crop (Citrus)/spp.	Area of collection
1	IC-311473	IPS/58a	Kagzi lime (*C. aurantifolia*)	Akola
2	IC-311474	IPS/59a	Kagzi lime (*C. aurantifolia*)	Akola
3	IC-311475	IPS/60	Kagzi lime (*C. aurantifolia*)	Akola
4	IC-311476	IPS/61	Mosambi (*C.sinensis*)	Aurangabad
5	IC-311477	IPS/62	Rootstock (*C. jambhiri*)	Aurangabad
6	IC-311478	IPS/63	Mosambi (*C. sinensis*)	Paithan, Aurangabad
7	IC-311479	IPS/64	Mosambi (*C. sinensis*)	Paithan,Aurangabad
8	IC-311480	IPS/65	Mosambi (*C. sinensis*)	Paithan,Aurangabad
9	IC-311481	IPS/66	Mosambi (*C. sinensis*)	Paithan, Aurangabad
10	IC-311482	IPS/67	Mosambi (*C. sinensis*)	Paithan, Aurangabad
11	IC-311483	IPS/68	Mosambi (*C. sinensis*)	Paithan, Aurangabad
12	IC-311484	IPS/69	Mosambi (*C. sinensis*)	Jalna
13	IC-311485	IPS/70	Mosambi (*C. sinensis*)	Jalna
14	IC-311486	IPS/71	Kagzi lime (*C. aurantifolia*)	Aurangabad
15	IC-311487	IPS/72	Kagzi lime (*C. aurantifolia*)	Aurangabad
16	IC-311488	IPS/73	Kagzi lime (*C. aurantifolia*)	Aurangabad
17	IC-311489	IPS/74	Mosambi (*C. sinensis*)	Ahmednagar
18	IC-311490	IPS/75	Mosambi (*C. sinensis*)	Ahmednagar
19	IC-311491	IPS/76	Mosambi (*C. sinensis*)	Ahmednagar
20	IC-311492	IPS/77	Rootstock (*C. jambhiri*)	Ahmednagar
21	IC-311493	IPS/78	Mosambi (*C. sinensis*)	Ahmednagar
22	IC-311494	IPS/79	Mosambi (*C. sinensis*)	Ahmednagar
23	IC-311495	IPS/80	Mosambi (*C. sinensis*)	Ahmednagar
24	IC-311496	IPS/81	Kagzi lime (*C. aurantifolia*)	Ahmednagar
25	IC-311497	IPS/82	Kagzi lime (*C. aurantifolia*)	Ahmednagar
26	IC-311498	IPS/83	Mosambi (*C. sinensis*)	Pune
27	IC-311499	IPS/84	Mandarin (*C. reticulata*)	Pune
28	IC-311500	IPS/85	Rootstock (*C. jambhiri*)	Pune
29	IC-311501	IPS/86	Mosambi (*C. sinensis*)	Pune
30	IC-311502	IPS/87	Mosambi (*C. sinensis*)	Ahmednagar
31	IC-311503	IPS/88	Mosambi (*C. sinensis*)	Ahmednagar
32	IC-311504	IPS/89	Mosambi (*C. sinensis*)	Aurangabad
33	IC-311505	IPS/90	Mosambi (*C. sinensis*)	Aurangabad
34	IC-322244	IPS-285	Kagzi lime (*C. aurantifolia*)	Amravati (M.S)
35	IC-322245	IPS-286	Kagzi lime (*C. aurantifolia*)	Washim (M.S.)
36	IC-322246	IPS-287	Kinnow (Hybrid)	Washim (M.S.)
37	IC-322247	IPS-288	Mosambi (*C. sinensis*)	Hingoli (M.S.)
38	IC-322248	IPS-289	Rough lemon (*C. jambhiri*)	Nanded (M.S.)
39	IC-322249	IPS-290	Mosambi (*C. sinensis*)	Nanded (M.S.)
40	IC-322250	IPS-291	Sathgudi (*C. sinensis*)	Nanded (M.S.)
41	IC-322251	IPS-292	Rough lemon (*C. jambhiri*)	Nanded (M.S.)
42	IC-322252	IPS-293	Rangpur lime (*C. limonia*)	Nanded (M.S.)
43	IC-322253	IPS-294	Mosambi (*C. sinensis*)	Nanded (M.S.)
44	IC-322254	IPS-295	Kagzi lime (*C. aurantifolia*)	Beed (M.S.)
45	IC-322255	IPS-296	Kagzi lime (*C. aurantifolia*)	Beed (M.S.)
46	IC-322256	IPS-297	Kagzi lime (*C. aurantifolia*)	Beed (M.S.)
47	IC-322257	IPS-298	Mosambi (*C. sinensis*)	Jalna (M.S.)
48	IC-322258	IPS-299	Rough lemon (*C.jambhiri*)	Jalna (M.S.)
49	IC-322259	IPS-300	Rough lemon (*C.jambhiri*)	Aurangabad (M.S)
50	IC-322260	IPS-301	Galgal (*C. pseudolimon*)	Ahmednagar (M.S.)
51	IC-322261	IPS-302	Kagzi lime (*C. aurantifolia*)	Pune (M.S.)
52	IC-322262	IPS-303	Mosambi (*C. sinensis*)	Jalna (M.S.)

(Chakrawar and Jature, 1980) in this area. It was observed in Balapur area of Akola that farmers add urea in weedicides and this is claimed to act more effectively in controlling the weeds in citrus orchards than applying weedicides alone.

Paithan area of Aurangabad is famous area for Mosambi cultivation. Two types of Mosambi were observed, one local type with smaller fruit and thick skin and another bigger size fruit with thin skin (nucellar Mosambi). Now farmers prefer to grow nucellar Mosambi, since they get better price in the market. This has made a parallel threat to local type Mosambi, though it has better post harvest life. NRCC selected many superior clones of Mosambi from these areas (Singh and Singh, 2003).

Badnapur and Ambad area of Jalna were visited to collect better clones of Mosambi. Total of 7 orchards were visited in this area, variability was observed in fruit size, skin thickness and longevity of orchards. In general, decline of citrus in this area was observed to start at the orchard age of 10 with orchard age lasting upto 20 years. However in Talegaon village, one orchard at the age of about 40 years is still in bearing stage and looked healthier without any pest infestation. Plants from these orchards were earmarked for further study. These plants may serve as mother plants for large-scale production of disease- planting material of Mosambi.

On the way to Rahuri 11 orchards of Mosambi and acid lime were explored and variability was observed in one orchard at Khultabad area. Fruit samples were collected from selected plant. In this area, Mosambi and acid limes are grown on commercial scale. Rahuri and Srirampur area, famous for Mosambi cultivation during 1960, were surveyed. However, not a single orchard more than 10 year old could be located.

Shrigonda area of Ahmednagar is famous for acid lime cultivation (Desai, *et al.* 1997). However, few orchards of Mosambi were also noticed in this area. A total of 9 orchards were explored in this area and variability was observed with regard to fruit yield, size of fruit and tree size. In this area few cluster bearing plants were selected for further investigation. Shirur area of Pune and Ganganagar area of Aurangabad were also explored. In this area beside acid lime and Mosambi, excellent rootstock plants were observed growing and fruit samples of Jambhiri was collected.

The trees were observed to be medium and heavy bearing. Fruit size variation was observed in sweet orange and more visibly in acid lime. One collection from a 12-year-old orchard was found to possess rich and well developed oil glands. The budsticks were collected from an orchard bearing good number of fruits and interestingly, the orchard appeared to be in excellent condition at the age of 45 yrs.

Cluster bearing in sweet orange was also observed. In one collection, only two plants were found as the best surviving members of a 10 yrs old orchard in Aurangabad district. The areas of Ahmednagar and adjoining Aurangabad experienced a shift from citrus to sugarcane cultivation in the past two decades.

During the exploration it was observed that most of the acid lime plants are affected by canker, except in Beed area near Parli. In Parli area, plants of acid lime looked healthy without any apparent disease and insect pest problem. This is one of the promising potential areas for citrus cultivation. Farmers in this area are growing acid lime on large scale and are getting good price of their produce.

Fig. 3 and 4: Threat to citrus genetic diversity in Central India: Large scale drying of Nagpur mandarin and cutting by farmers due to water shortage in Central India

In Limbgaon, Nanded more than 70 per cent plants were observed to be affected by *Phythopthora*. Limbgaon area of Nanded is famous for raising nursery plants of Mosambi and acid lime on commercial scale and supplying the seedling to the farmers in different parts of Maharashtra. Chakrawar and Rane (1977) selected superior clone of mandarin (mutant) from these area. In Srigonda area, very close planting (3m x3m) of acid lime was observed. This was in sharp contrast to other areas of Maharashtra like Akola, where planting distance of 6m x 6m is maintained by the farmers. During the exploration it was observed that farmers were not growing any rootstock plants or other non-commercial citrus in their orchards. It is, therefore, important to collect all the available rootstocks and other non-commercial citrus species from the area, so that these materials may be evaluated and some promising ones identified.

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