



AVOCADO GERMLASM CONSERVATION AND IMPROVEMENT IN GHANA



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INTRODUCTION – LOCATION OF GHANA

- Ghana lies in the center of the West African coast.
- It shares 2,093 km of land borders with three French-speaking nations,
 - Burkina Faso (548 km) to the north,
 - Côte d'Ivoire (668 km) to the west, and
 - Togo (877 km) to the east.
- To the south is the **Gulf of Guinea**.



INTRODUCTION- CLIMATIC CONDITIONS

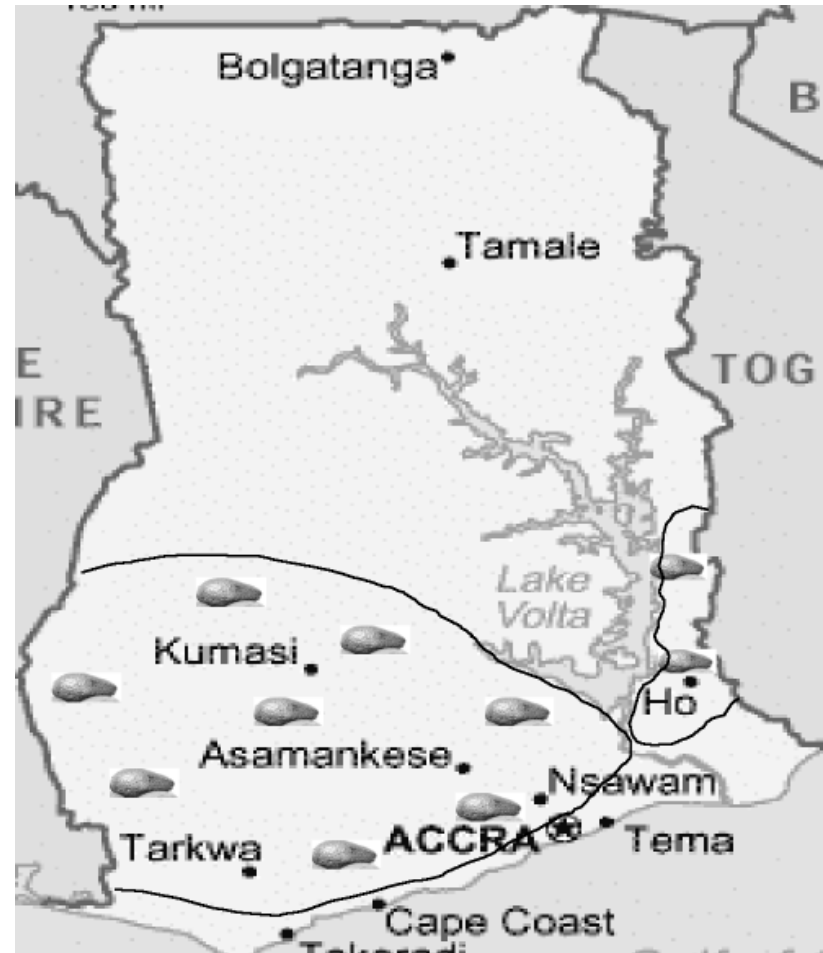
- **Annual rainfall range:**
1,100 mm - 2,100 mm
- **Temperature range: 18-42°**
- **Highest temperatures (42°C) occur in March, and the lowest (18°C) in August**



INTRODUCTION

IMPORTANCE OF AVOCADO

- **Avocado (*Persea americana* Mill)** is a very important crop in Ghana and is one of the potential promising export crops.
- The crop is mainly cultivated in the forest belt of Ghana.



INTRODUCTION HISTORY AND INTRODUCTION INTO GHANA

- Views are varied between **historians and scientists**, with regards to the period of the introduction.
- First introductions were by the **missionaries during pre-colonial times.**





- **The first recorded planting of avocado was at Aburi (near Accra) in 1870**
- **Peasant production was recorded in 1907 (Anon, 1961).**



CULTIVARS INTRODUCED

**West Indian and West Indian x
Guatemalan hybrids**

- **Booth 7 & 8, Fuchsia, Lula, Monroe, Trapp, Choquette, Collinson, and Waldin)**
- **Cultivars were introduced by the Plant Protection and Quarantine unit of U.S.D.A-& Animal and Plant Health Inspection Services and USAID.**



CULTIVARS INTRODUCED

In the 1960s

- ‘Duke’, ‘Ettinger’ and
- ‘Fuerte’ were

introduced from the National
Germplasm Repository (NGR) in Miami,
Florida



JUSTIFICATION FOR STUDY

- **Due to neglect all the mother plants that were introduced cannot be identified or located.**
- **There is a challenge of identification of races and cultivars and their crosses.**
- **Since the original introductions were made, nearly all subsequent plantings have been made from seed sources and not from grafted materials.**



- **Ghana's entire avocado production is grown by smallholders.**
- **Fruits are obtained from backyard plantings and volunteer crops scattered in cocoa and other farms in most parts of the forest belt.**



DIVERSITY

- Avocado fruits of different shapes, sizes and colours can be seen displayed for sale all year round when travelling along the main road networks in the avocado producing regions, an indication of a large gene pool in the country.



- **Commercial avocado plantations are not available**
- **There are no certified avocado nurseries to supply growers with grafted material**
- **Planting materials can be obtained from the Forest and Horticultural Crops Research Centre-Kade of the University of Ghana (Nkansah unpublished).**



- Few studies have been carried out on avocado especially in terms of genetic conservation and improvement.
- **Studies on genetic characterization using microsatellite markers revealed that most of the lines belong to the West Indian race (Acheampong *et al*, 2008).**
- **It has been recommended that further studies using advanced form of markers to differentiate some Guatemalan hybrids and that of the Indian race should be carried out.**



- **Introductions from the three races is needed to augment the gene pool and improve upon the Ghanaian avocado industry.**



- **More attention must be given to expand the genetic base and select lines that meet consumer preferences.**
- **This focus therefore calls for further exploration and collection of materials from the vast avocado gene pool that exists in the country, after several decades of its cultivation.**



OBJECTIVES

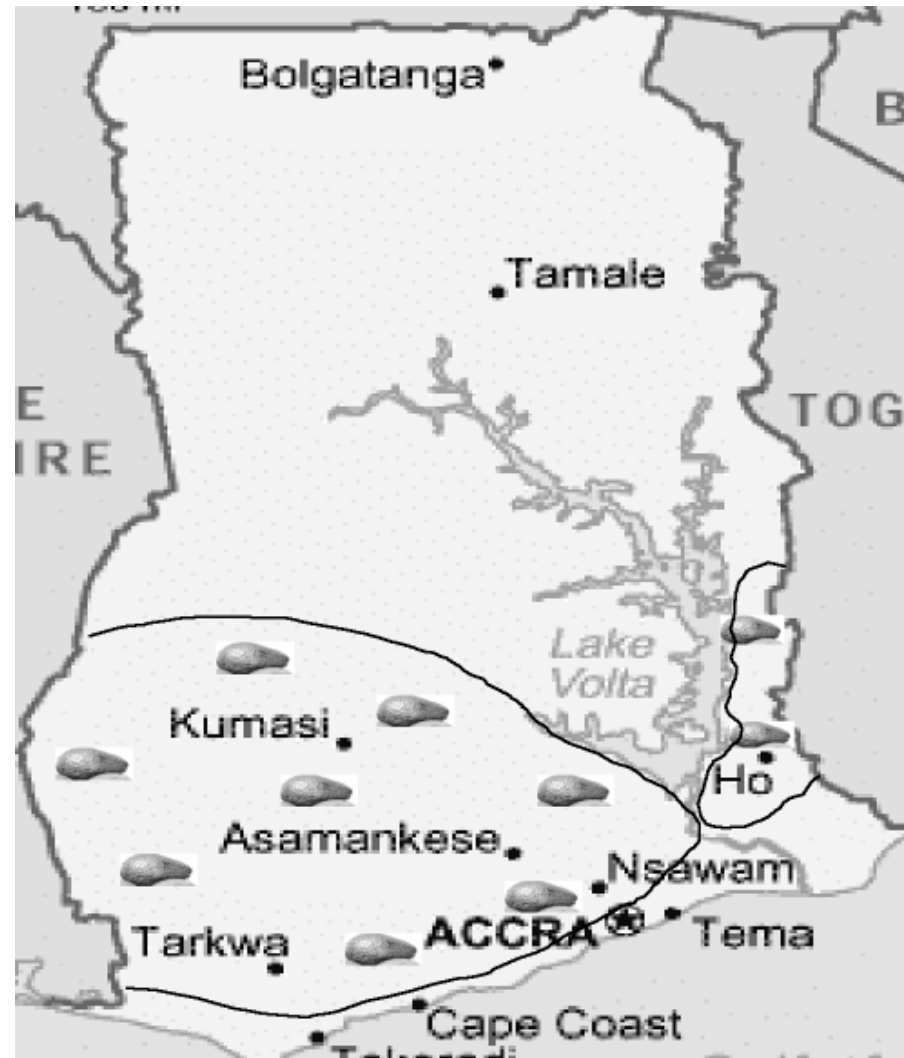
- **Collect both local and leading world avocado cultivars and evaluate performance in a museum**
- **Conserve, characterise and select desirable genotypes**
- **Multiply selected genotypes by vegetative propagation and release to farmers and**
- **Use detailed trait characteristics of genotypes in the museum for varietal improvement and other agronomic purposes.**



MATERIALS AND METHODS

Survey and collection of avocado accessions

- 110 local landraces were selected during field visits to 4 out of 8 regions (Ashanti, Brong Ahafo, Western and Eastern) to collect avocado accessions and map plant positions.









FOREIGN INTRODUCTIONS

- Five (5) cultivars:
 ‘**Hass**’, ‘**Fuerte**’,
 ‘**Ryan**’, ‘**Ettinger**’ and
 ‘**Nabal**’ were
 obtained from
 South Africa.
- These materials
 have been
 established at
 FOHCREC, Kade in
 the **Eastern Region**
 of **Ghana**.



LOCATION OF EXPERIMENTS

Evaluation in Experimental farms

- The performance of the accessions and introductions are being evaluated at the **University of Ghana Forest and Horticultural Crops Research Centre, Kade. FOHCREC** is about **120 kilometres North West of Accra** in the **Eastern Region**.
- The experimental farm/orchard is located in the forest zone, about **114m** above sea level on latitude **6°1573'N** and longitude **0°9153'W**.



- **The dominant soil is Haplic Acrisol (FAO/UNESCO, 1990; Nkansah et al, 2007).**
- **The annual rainfall ranges between 1300-1700mm and has bi-modal distribution with two peaks around June-July and September – October.**
- **Temperature at FOHCREC ranges between 25-38°C (Ofosu-Budu, 2005).**



EXPERIMENT 1

- The first accessions, mainly landraces were planted in 2004.
- Accessions were planted in lines in a completely randomized design with 4 replications



EXPERIMENT 2

- The second planting comprising five (5) cultivars from South Africa and nine (9) selected landraces from Experimental Farm I were planted in 2010.
- The experimental design used was RCBD and replicated 4X



New Establishment



DATA COLLECTION

- **Morphological characterization**
- ***Evaluation of leaf characteristics***
- ***Evaluation of tree characteristics***
- ***Evaluation of fruit characteristics***
- ***Yield performance of accessions***
- ***Growth performance of landraces and South African introductions***
- ***Data was subjected to ANOVA.***

RESULTS

Fig. 1. Leaf shape of Accessions

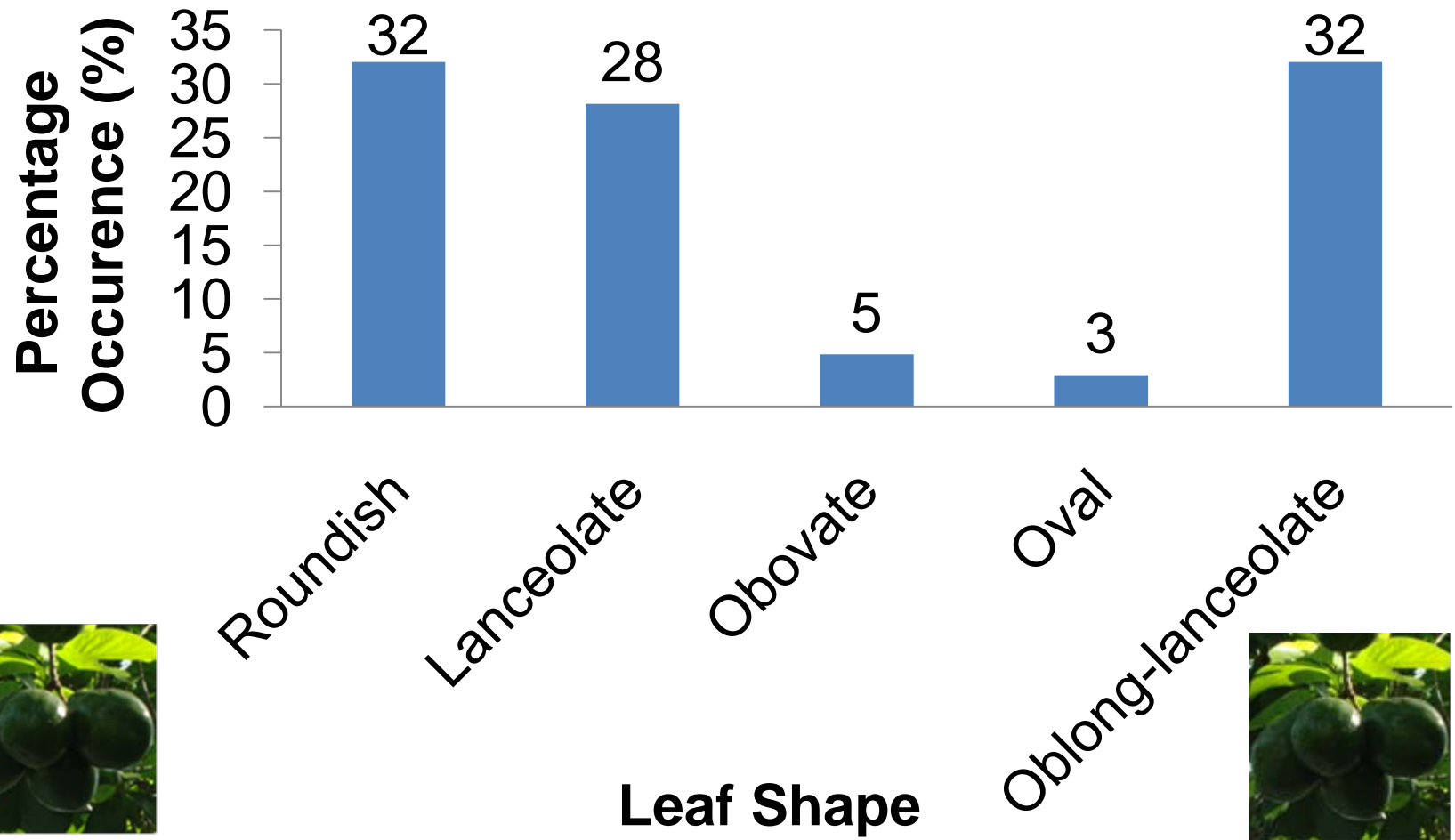


Figure 2. Leaf Colour Distribution

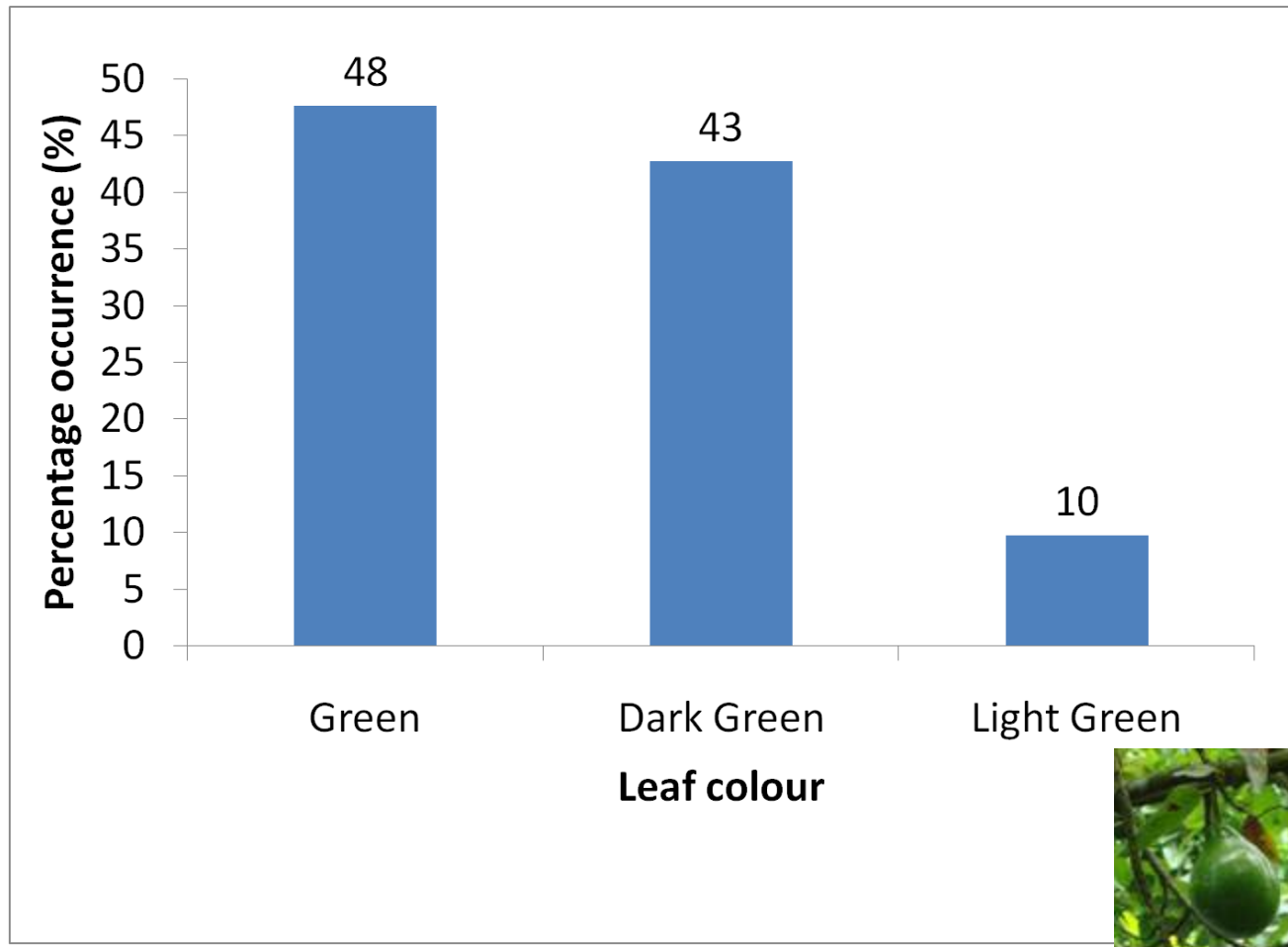


Figure 3. Leaf Margin of Accessions

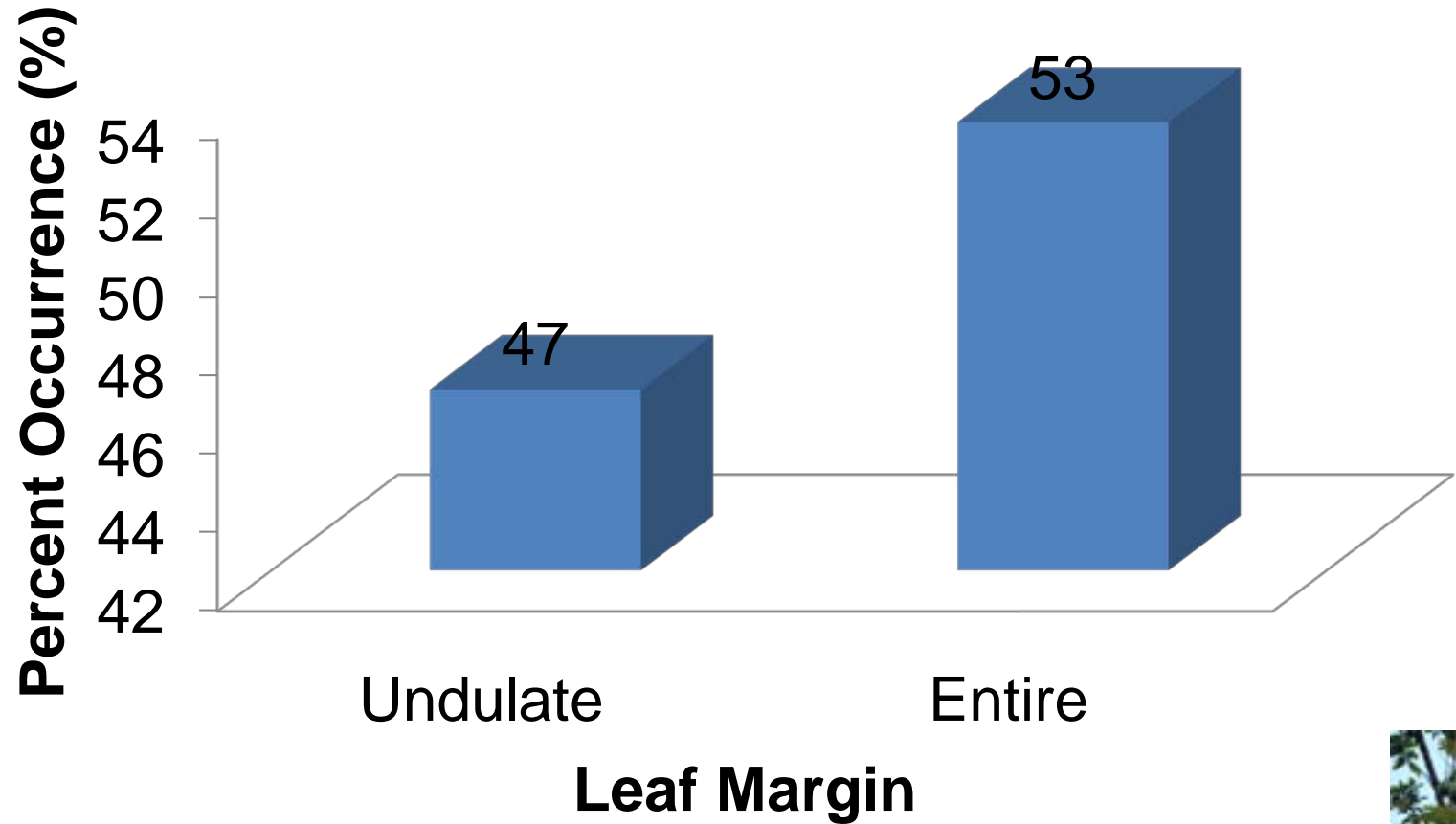


Figure 4. Leaf Base Distribution

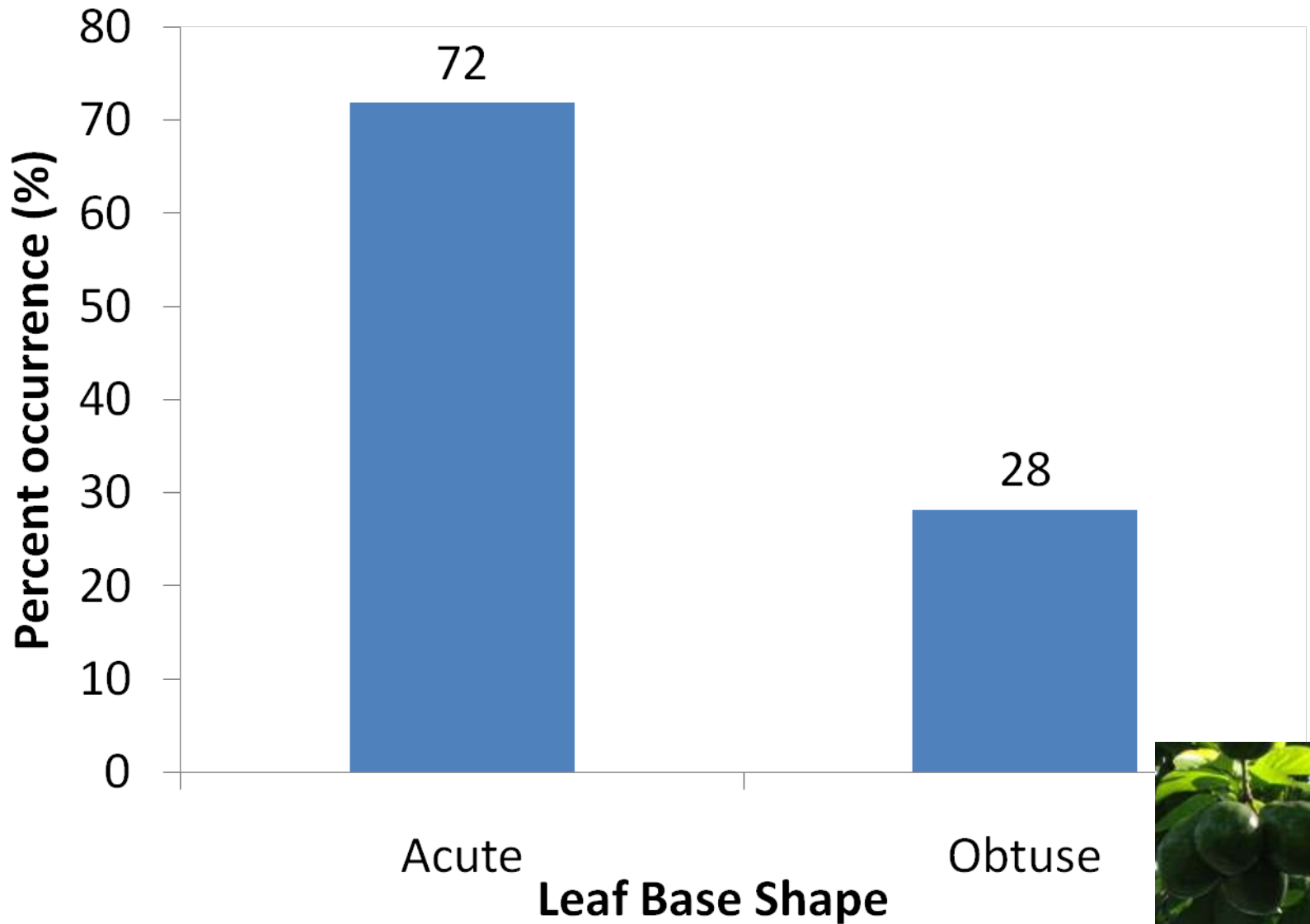


Fig. 6 Fruit Shape of Accessions

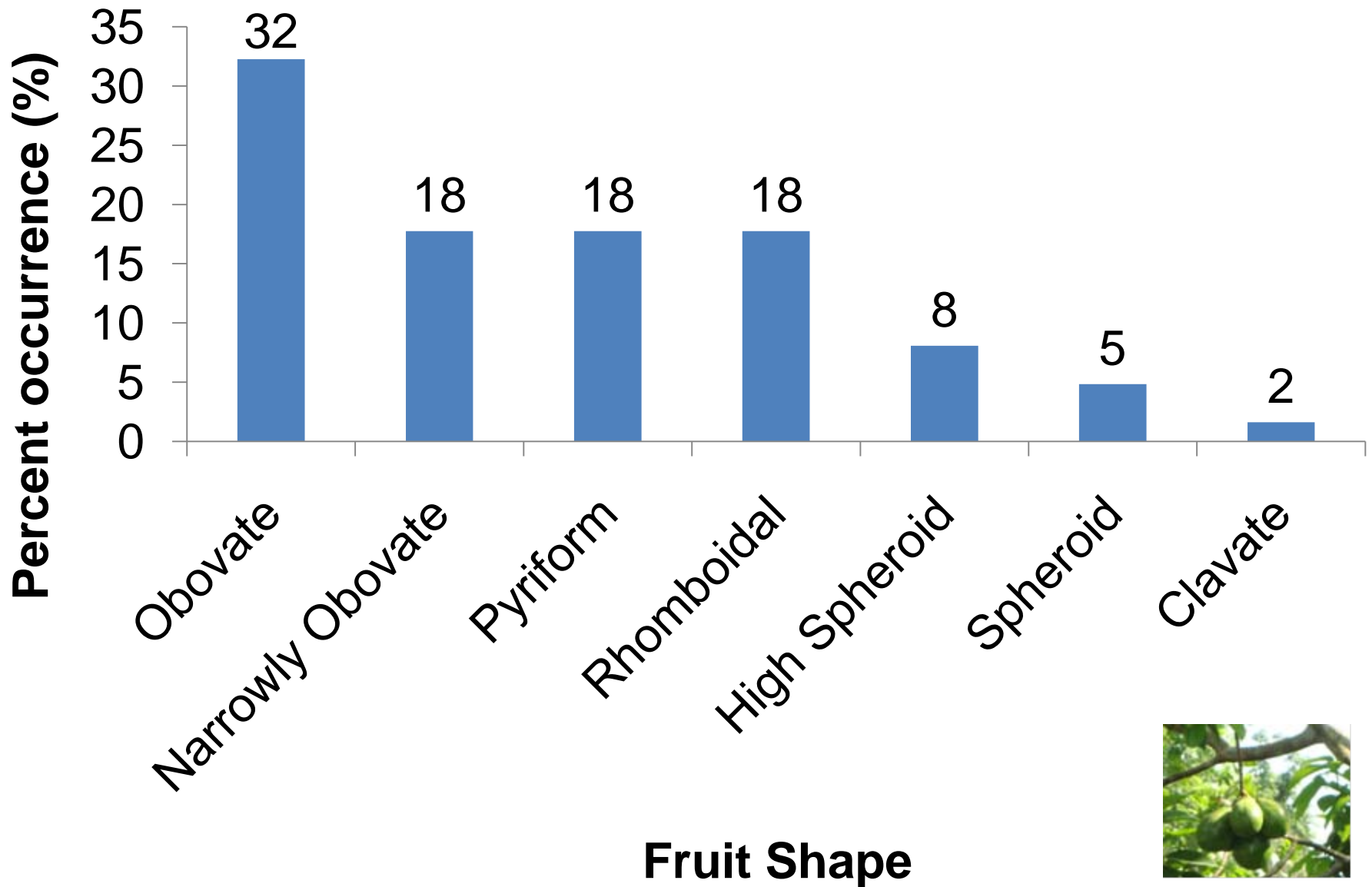


Figure 7. Fruit Habit of Accessions

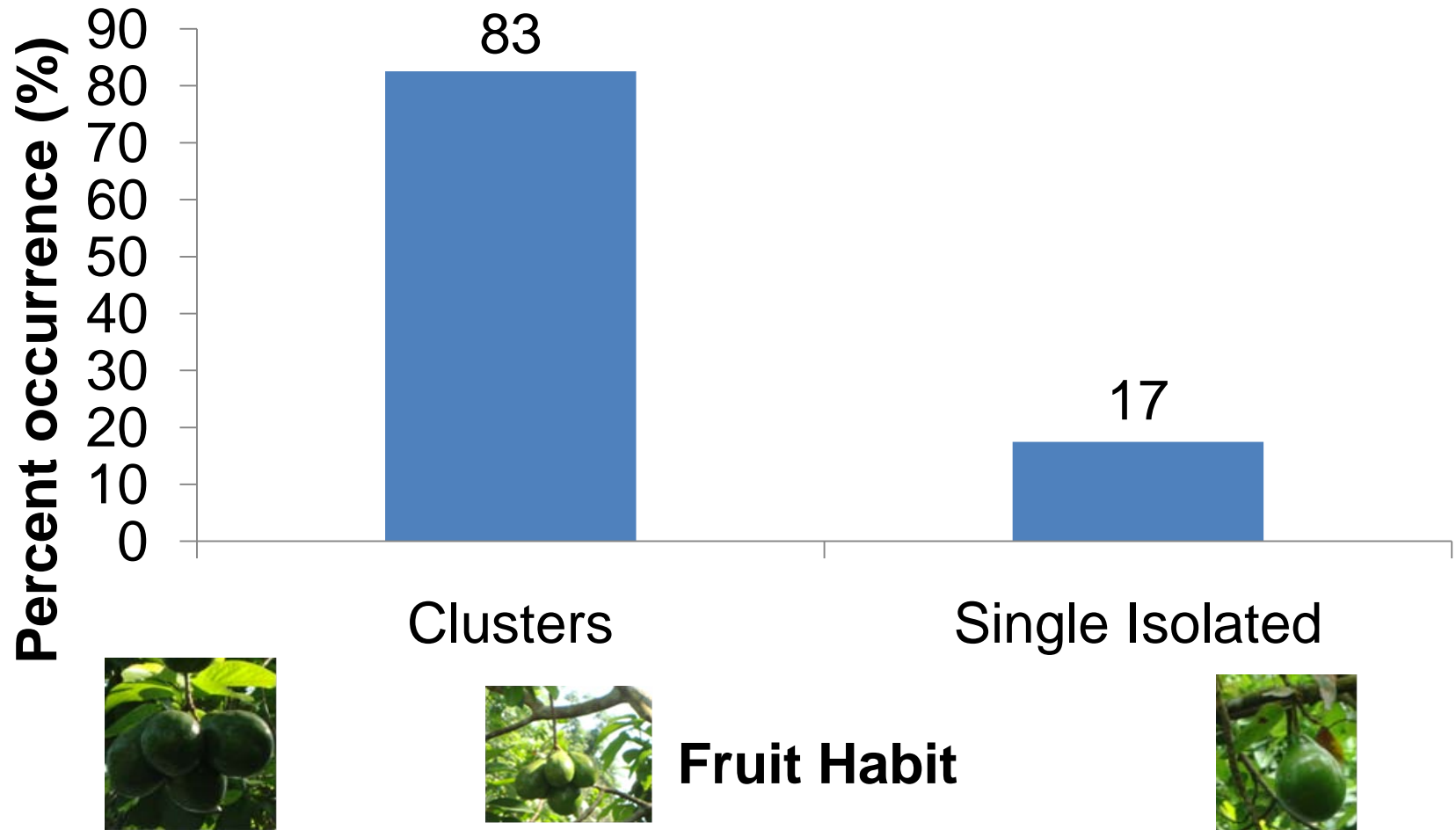


Figure 8. Fruit Apex Shape

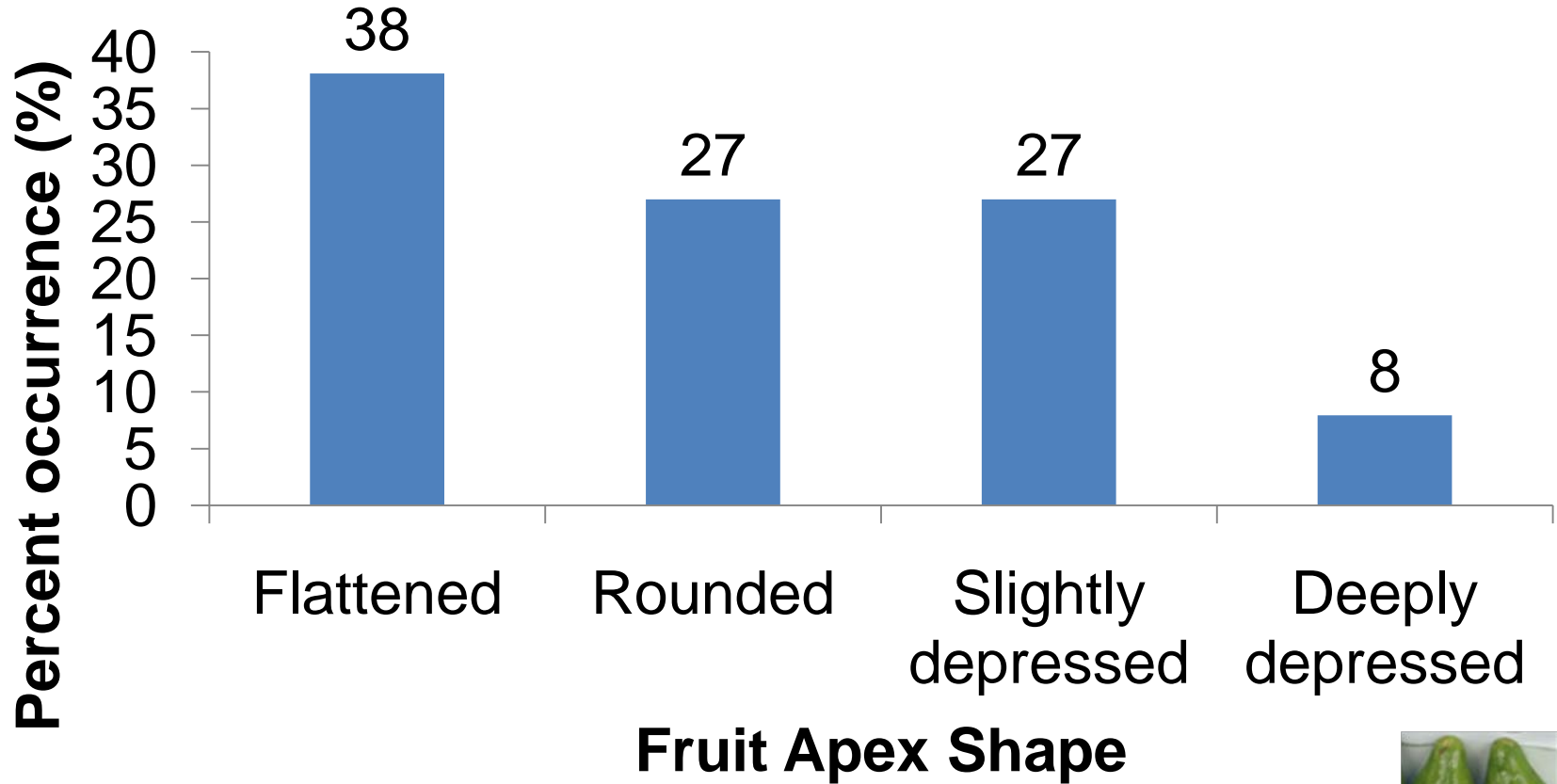


Figure 9. Ridges on Fruit

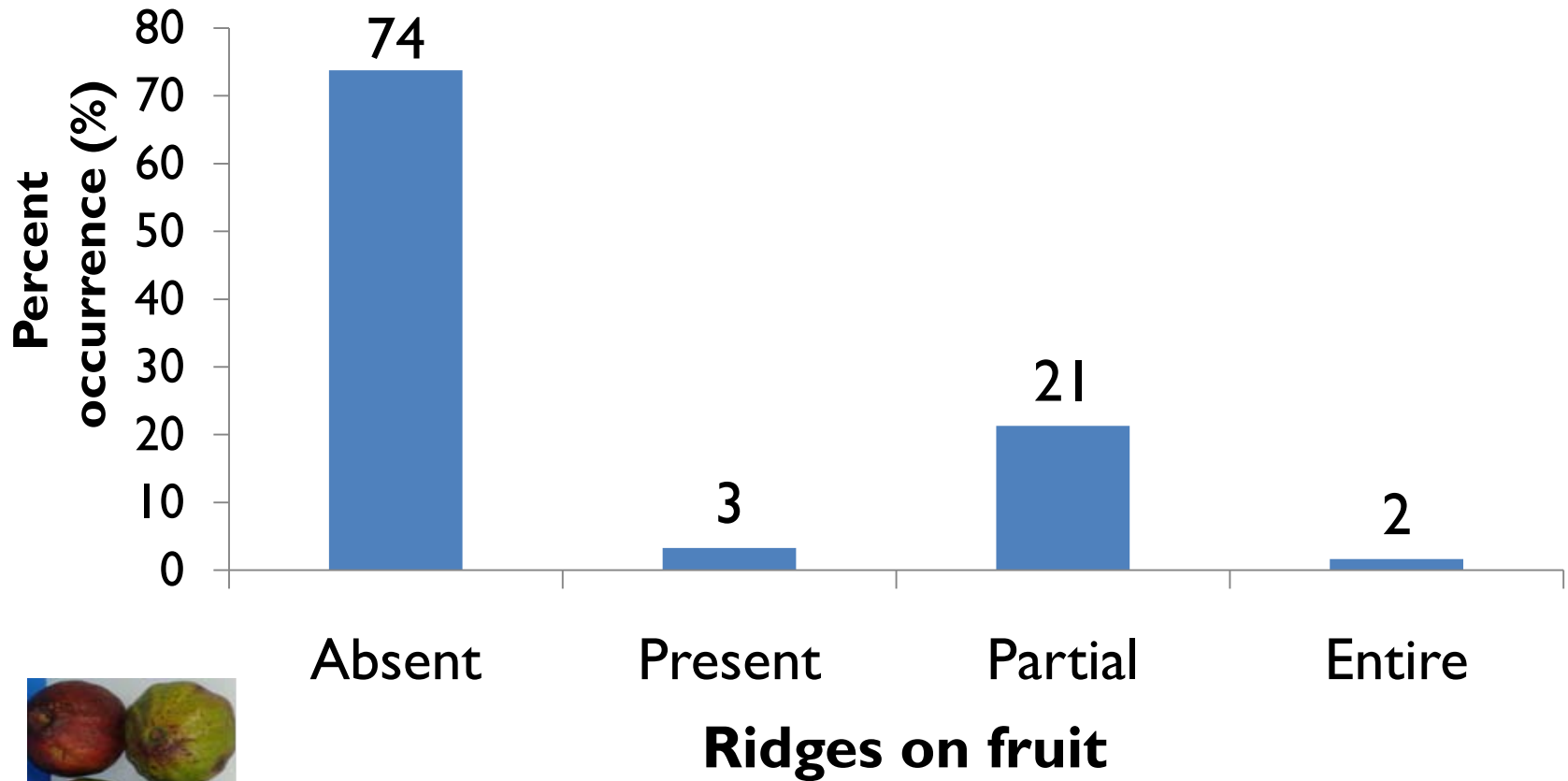


Fig. 10. Gloss of Skin of Accessions

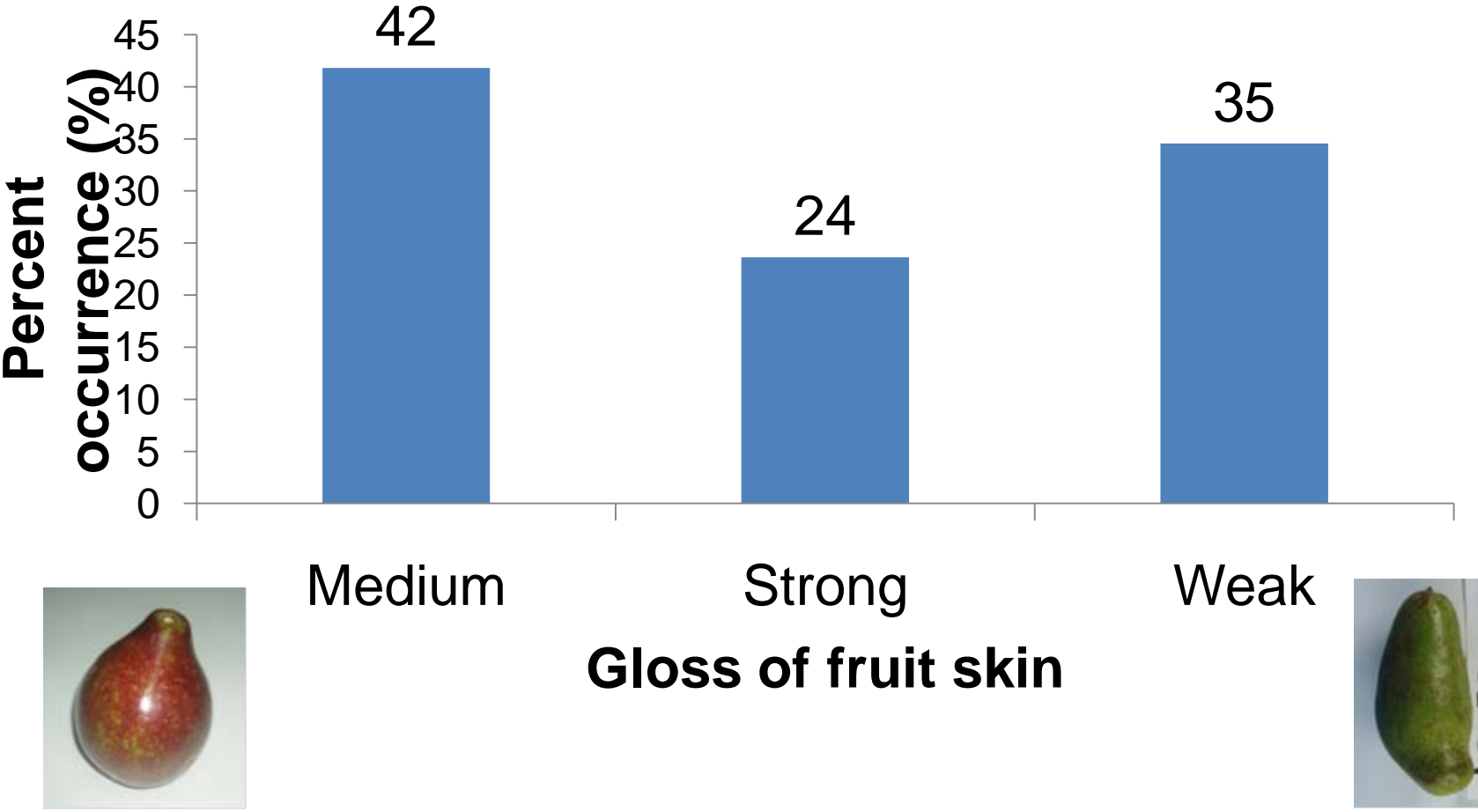


Fig. 11. Tree Shape of Accessions

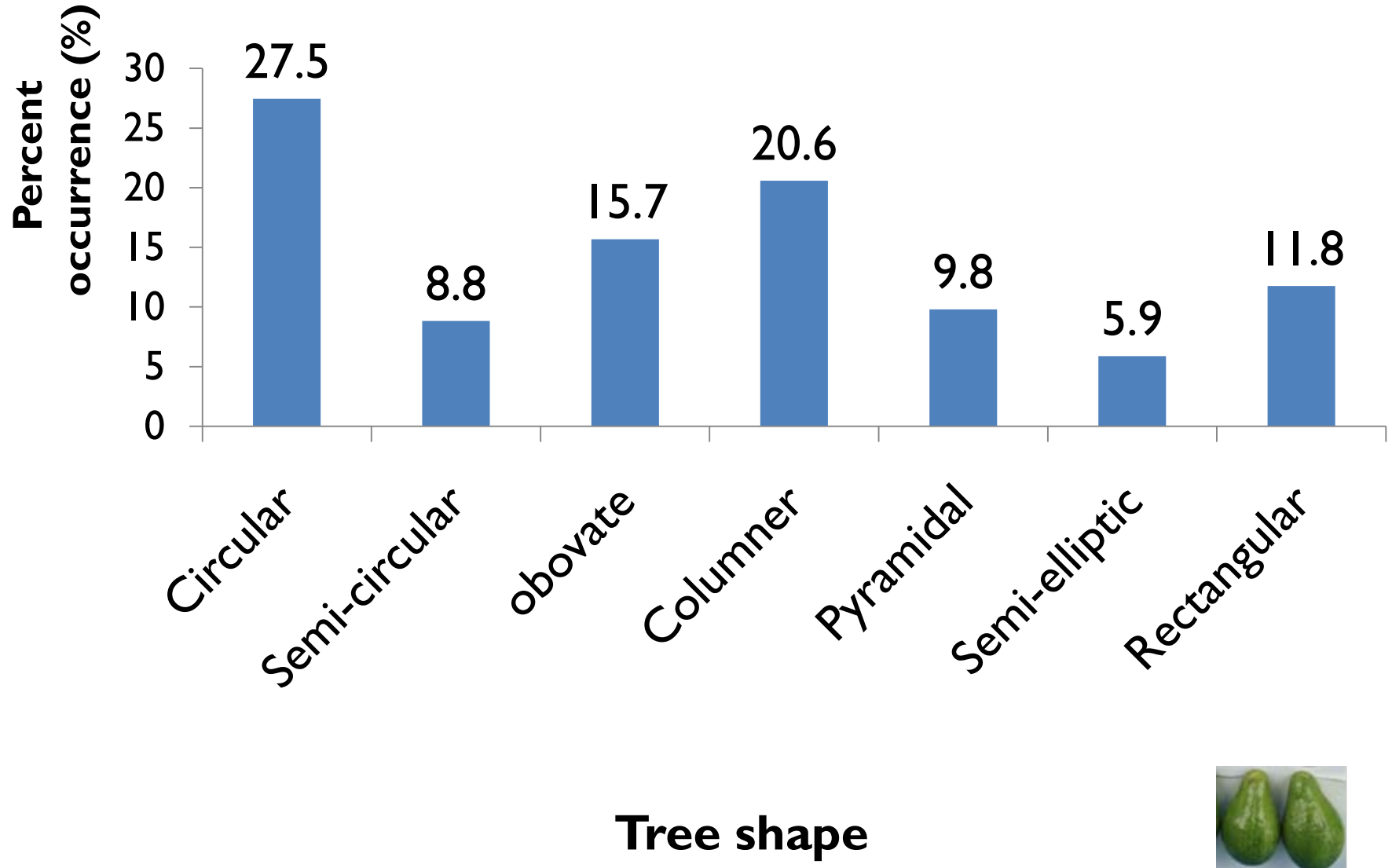


Fig. 12. Tree Branching Pattern

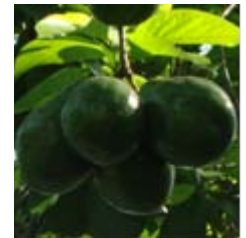
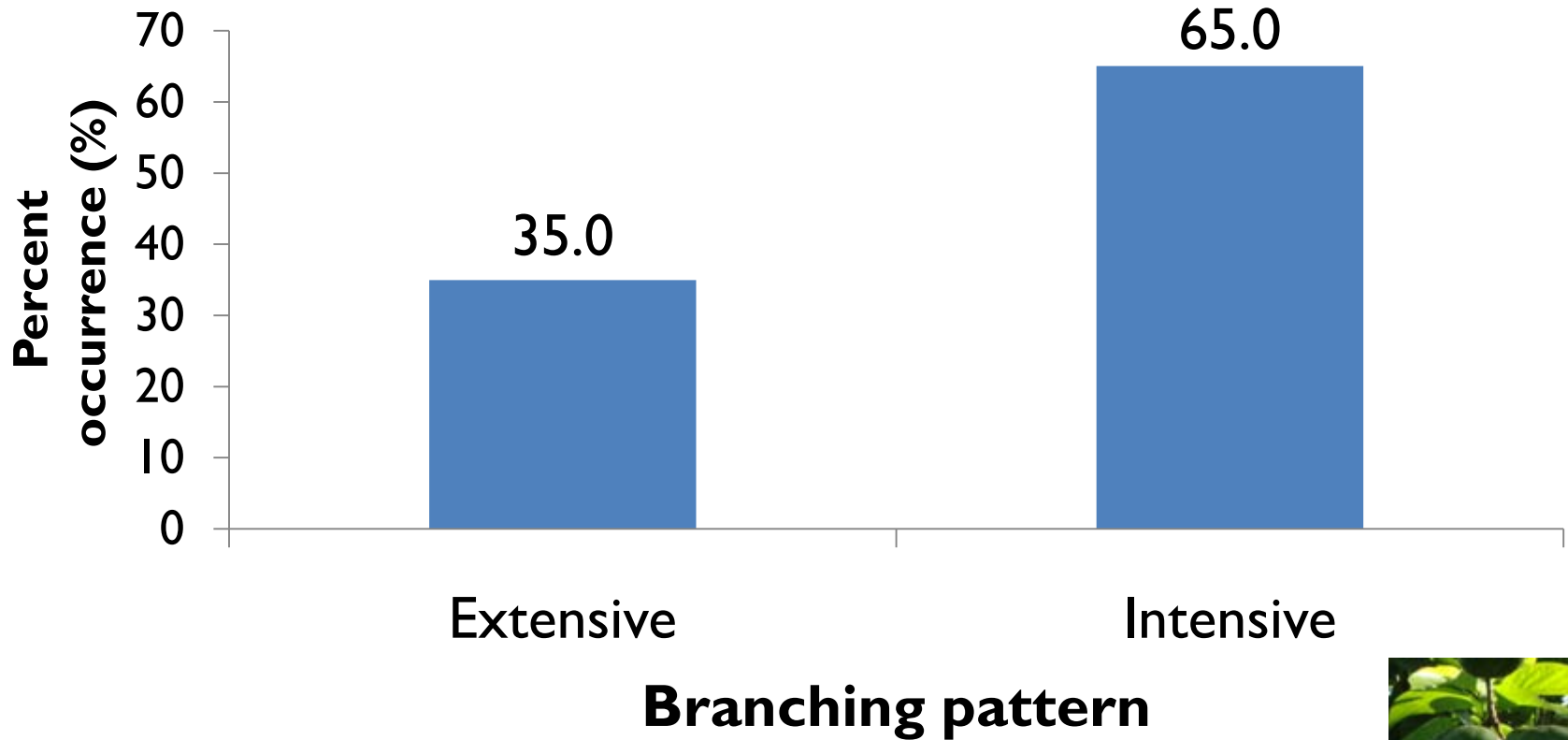


Fig. 1 Yield and yield component range of accessions

Item	Range
Fruit number (no./plant)	2.00 – 219.0
Fruit weight (g/plant)	132.0 – 15716.5
Yield (t/ha)	0.13 – 15.72



Table 2. Growth performance of some cultivars/landraces

Variety /Acc	Plant ht. (cm)	Leaf No. /plant	Plant girth (cm)
Ettinger	57.1	68.7	10.3
Fuerte	50.4	39.3	9.2
Hass	54.0	50.9	10.2
Nabal	37.6	32.2	10.2
Ryan	50.2	56.1	9.7
LR1	41.5	44.0	10.3
LR 2	44.3	57.0	11.5
LR 3	36.0	38.6	9.7
LR 4	48.6	67.0	10.2
LR 5	56.2	76.0	8.9
LR 6	38.5	31.2	6.0
LR 7	42.0	20.5	6.5
LR 8	39.3	22.0	6.9
LR 9	34.0	13.0	5.2
Lsd (5%)	2.02	2.69	1.06



Table 3. Comparative growth traits of introductions/landraces, 2 yrs old

Introduction/ landraces	Plant height (cm)	Number of leaves (no./plant)	Plant girth (cm)
Introductions	49.8	49.4	9.9
Landraces	42.3	41.0	8.4
T-test (5%)	ns	ns	ns



CONCLUSIONS

- **The present study shows that considerable genetic variability exists in growth and yield performance which offers scope for selection and breeding.**
- **Further studies in fruit quality, disease and pest tolerance, post harvest and other agronomic trials should be encouraged.**





CONCLUSIONS

- **This germplasm collection is the first of its kind in West Africa where data has been collected over the years.**



- **Potential collaborators are welcome to join our efforts to improve upon the avocado industry in West Africa.**



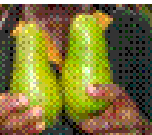
RECOMMENDATIONS

- It is recommended that **more cultivars and other accessions** should be collected to increase the **genetic base**.



COLLABORATION

- **Collaboration is needed for genetic, physiological and biochemical studies with industry and researchers worldwide to strengthen the avocado industry in Ghana.**
- **Scientists are available and ready to collaborate**
- **Land for research is available**



ACKNOWLEDGEMENT

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**THANK YOU
FOR
YOUR ATTENTION**

