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TWC/26/25
ORIGINAL: English
DATE: September 1, 2008

UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

TECHNICAL WORKING PARTY ON AUTOMATION AND COMPUTER PROGRAMS

Twenty-Sixth Session
Jeju, Republic of Korea, September 2 to 5, 2008

USE OF IMAGE ANALYSIS IN DUS TESTING

Document prepared by experts from Australia

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Use of Image analysis in DUS testing

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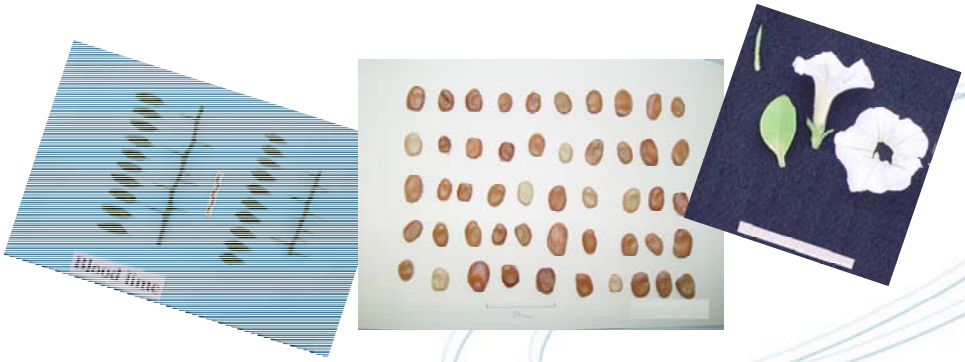

Technical Working Party on Automation and Computer Programs, 26th session, 2-5 Sept 2008 Jeju, Korea

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Background

Australia has a breeder testing system

- *DUS examiners visit trials which are often 1000's of km from the office*
- *many trials include varieties which are the first applications of the species – no national descriptor or test guideline*
- *DUS examiners obtain photographic records of varieties included in the trial for future reference and to assist in preparing national descriptors or test guidelines*

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Some advantages of image analysis

- *Images of a number of plant parts can be quickly recorded*
  - saves time in field
- *If image is saved analysis can be re-run anytime*
  - can be useful backup/check if needed
- *Don't always need to know what will be measured at time*
  - eg trying out new characteristics, objections
- *Measurements can be more reliable and consistent*
  - eg angles and curves are often difficult manually
  - Ability to zoom-in on small plant parts

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UTHSCSA Image Tool

- *Developed by Department of Dental Diagnostic Science at The University of Texas Health Science Center, San Antonio, Texas.*

Freely downloadable from uthscsa website

- *http://ddsdx.uthscsa.edu/dig/itdesc.html*

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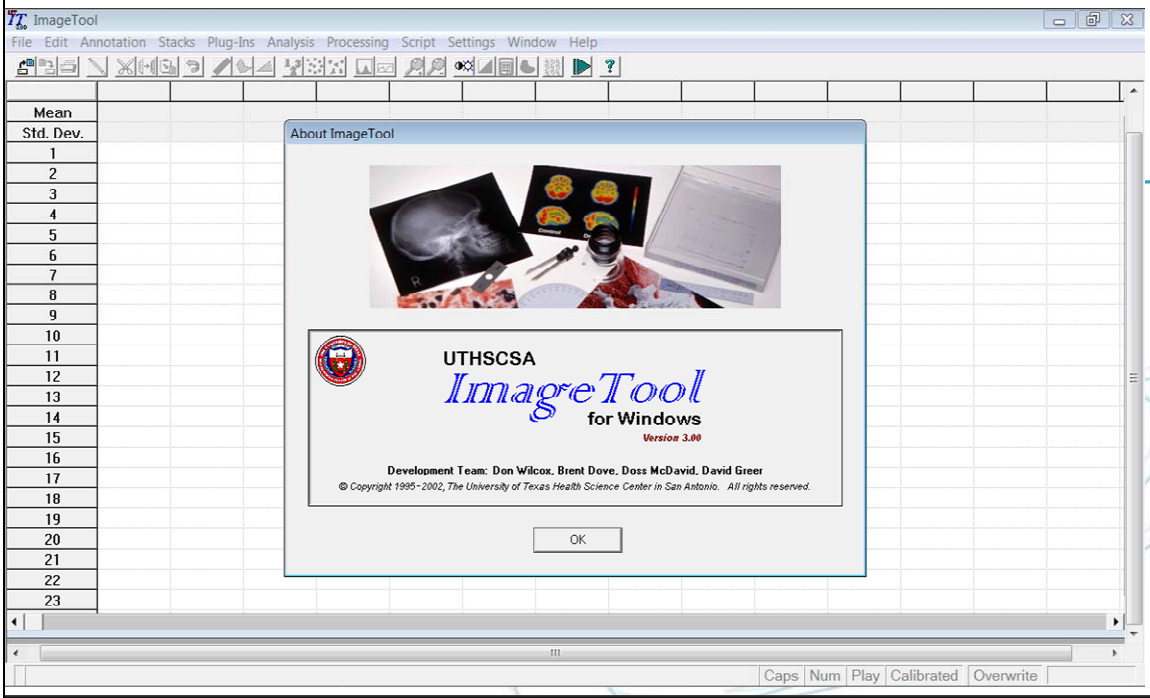

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What can it do?

- *Measures distance, angle, area and perimeter*
- *Counts of objects in area of interest*
- *Has inbuilt scripting language to automate tasks*
- *Many other functions*

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Creating the image

Although many images can be tidied up later it is much easier if minimal amount of editing is done. Some important considerations about creating the image:

- *make sure a clear scale is included in the photo*
- *try to ensure as sharp a contrast as possible between the objects and the background*
- *make sure no objects are touching.*
- *orientate all objects the same way*
- *remove any extra parts that are not intended to be measured.*

- *Keep objects as flat as possible*

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Obtaining data from the image

- *Data can be gathered manually or automatically.*

  - As data is gathered it is added to a Results sheet.

  - The data on the Results sheet can be exported to a text file or spreadsheet program.

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Manual measurements

- *Manual measurements are the easiest to obtain and requires the least setting up.*
- *It is useful where a small number of measurements are needed or the image is unsuitable for automatic measurements.*
- *It does not require the image to be converted to grayscale.*
- *Normally the only set up required is to calibrate the spatial measurements using the scale on the image of known length. Once calibrated, distance between any 2 points on the image can be measured by using the Distance button on the Toolbar.*

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Automatic measurements

- ***Automatic*** *measurements are more difficult to set up but can provide rapid data for a number of parameters.*
- *Very useful for large numbers of repetitive measurements on similar plant parts.*
  - For example a photo can be taken of 50 leaves of a variety laid out on a contrasting background. Once the most appropriate settings are determined the same settings can be used for other similar images. In this way many samples from different varieties or reps can be rapidly collected. Once set it only takes Image Tool a few seconds to analyse an image and send the data to the Results sheet. Obviously, not all plant parts lend themselves to this method. (eg it is difficult to automatically measure length of wheat ears. However it is possible to measure them manually)

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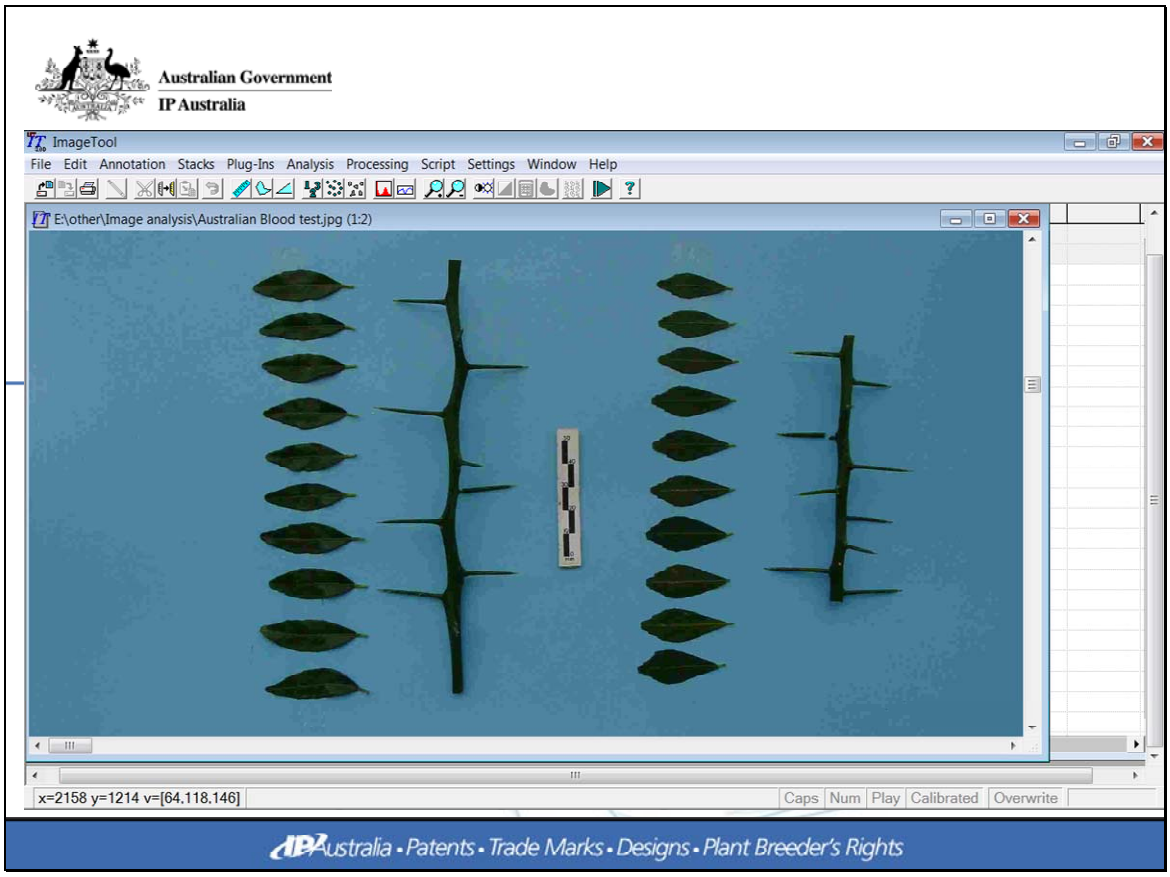
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ImageTool
File Edit Annotation Stacks Plug-Ins Analysis Processing Script Settings Window Help
E:\other\Image analysis\Australian Blood test.jpg (1:2)
x=2158 y=1214 v=[64,118,146]
Caps Num Play Calibrated Overwrite
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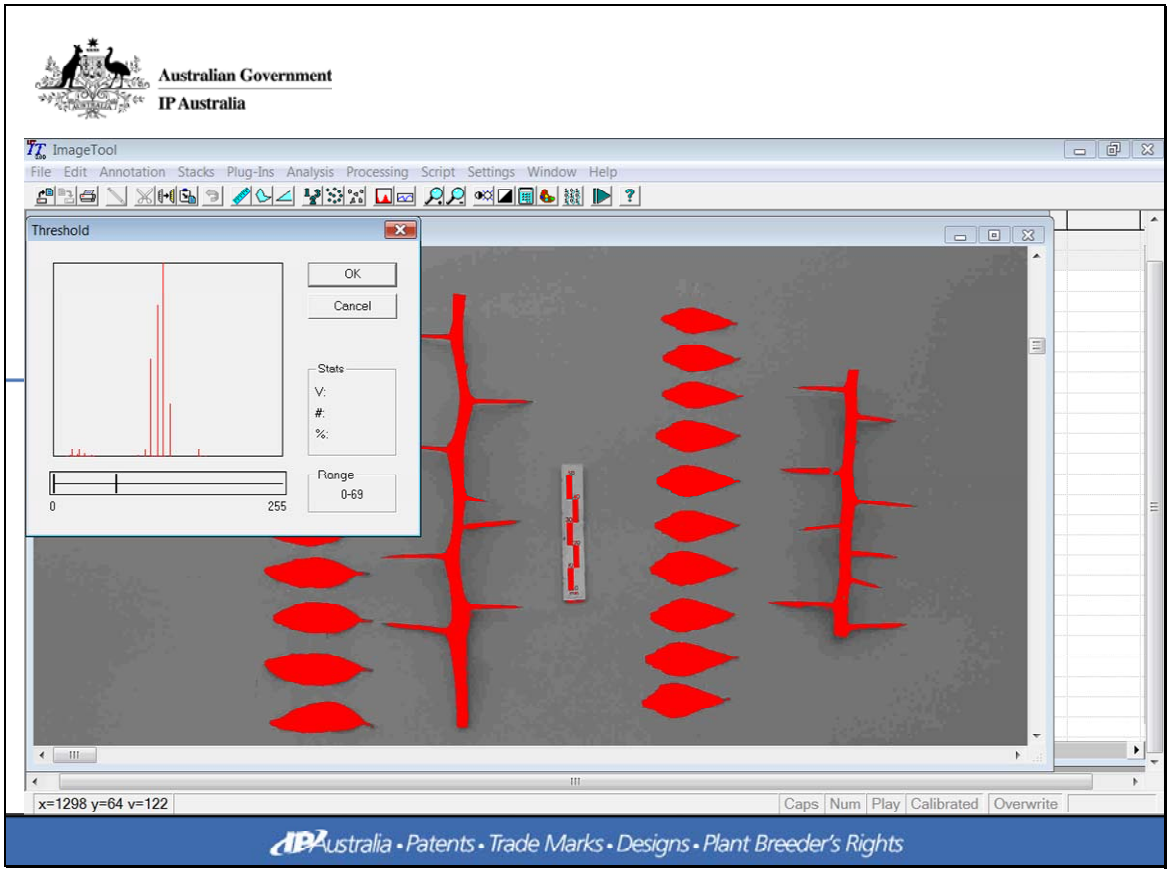
Australian Government
IP Australia
ImageTool
File Edit Annotation Stacks Plug-Ins Analysis Processing Script Settings Window Help
Threshold
OK
Cancel
Stats
V:
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Range
0-69
0
255
x=1298 y=64 v=122
Caps Num Play Calibrated Overwrite
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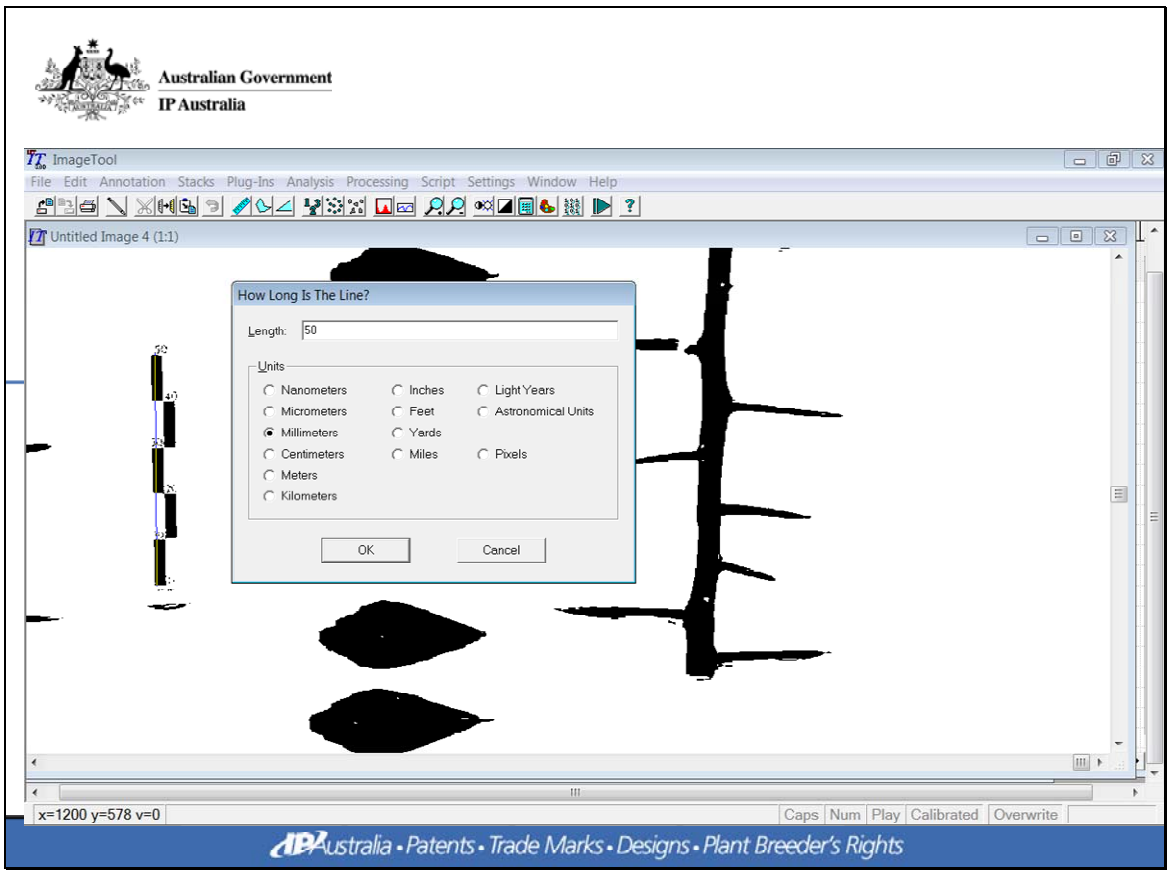
Australian Government
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ImageTool
File Edit Annotation Stacks Plug-Ins Analysis Processing Script Settings Window Help
Untitled Image 4 (1:1)
How Long Is The Line?
Length: 50
Units
Nanometers
Micrometers
Millimeters
Centimeters
Meters
Kilometers
Inches
Feet
Yards
Miles
Light Years
Astronomical Units
Pixels
OK
Cancel
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Caps Num Play Calibrated Overwrite
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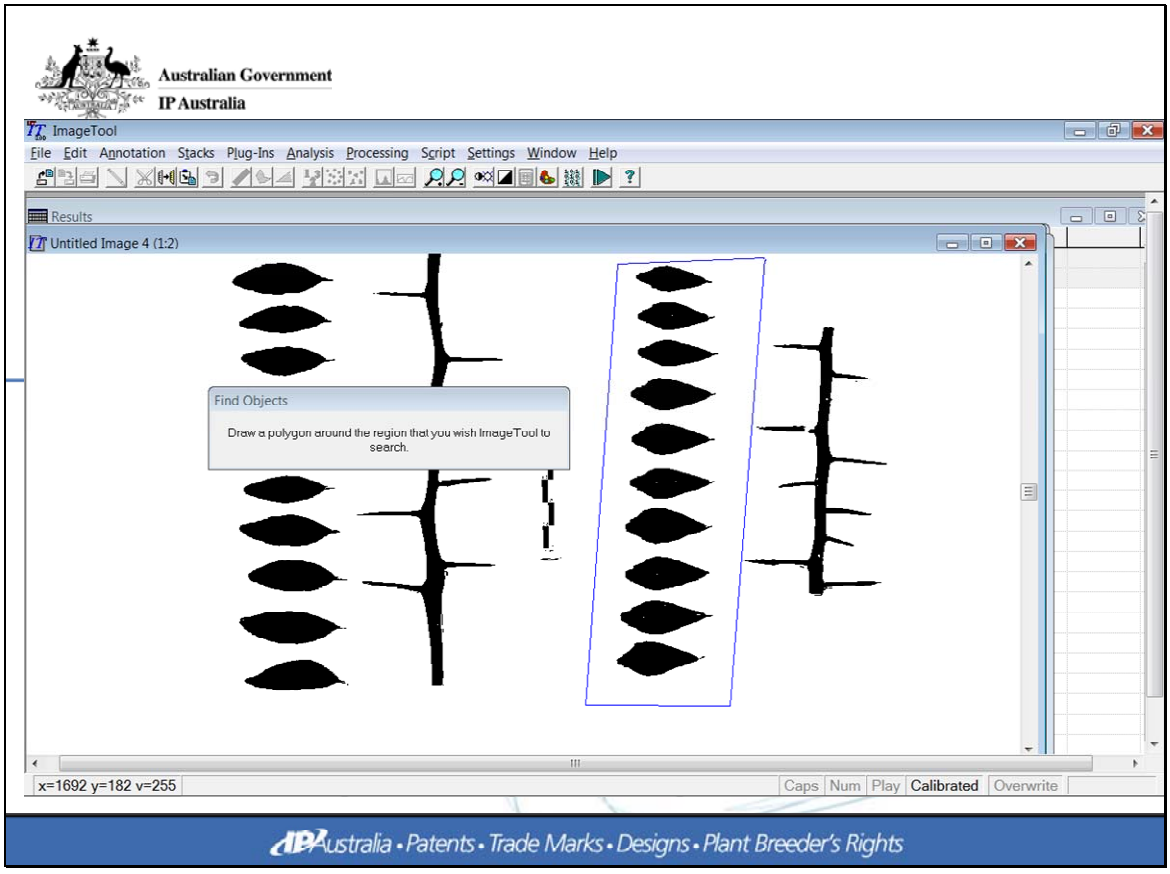
Australian Government
IP Australia
ImageTool
File Edit Annotation Stacks Plug-Ins Analysis Processing Script Settings Window Help
Results
Untitled Image 4 (1:2)
Find Objects
Draw a polygon around the region that you wish ImageTool to search.
x=1692 y=182 v=255
Caps Num Play Calibrated Overwrite
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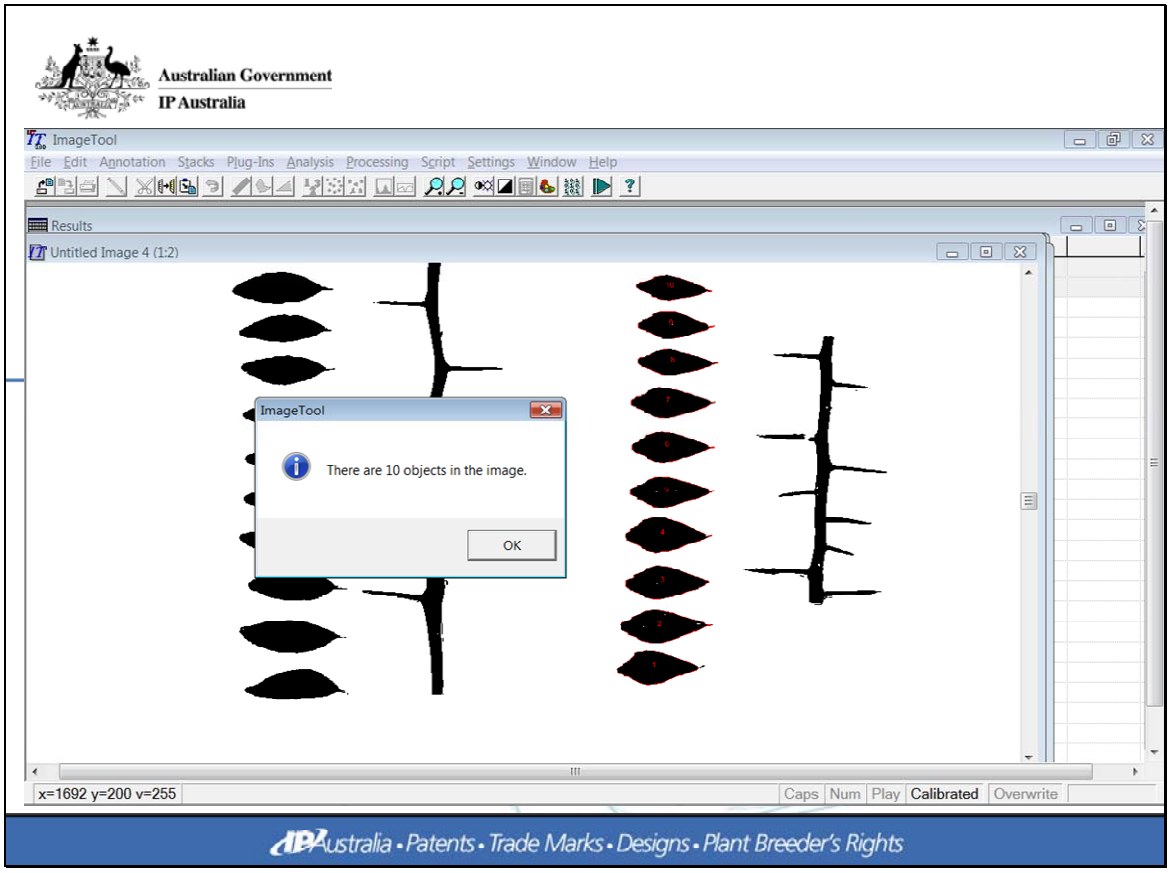
Australian Government
IP Australia
ImageTool
File Edit Annotation Stacks Plug-Ins Analysis Processing Script Settings Window Help
Results
Untitled Image 4 (1:2)
ImageTool
There are 10 objects in the image.
OK
x=1692 y=200 v=255
Caps Num Play Calibrated Overwrite
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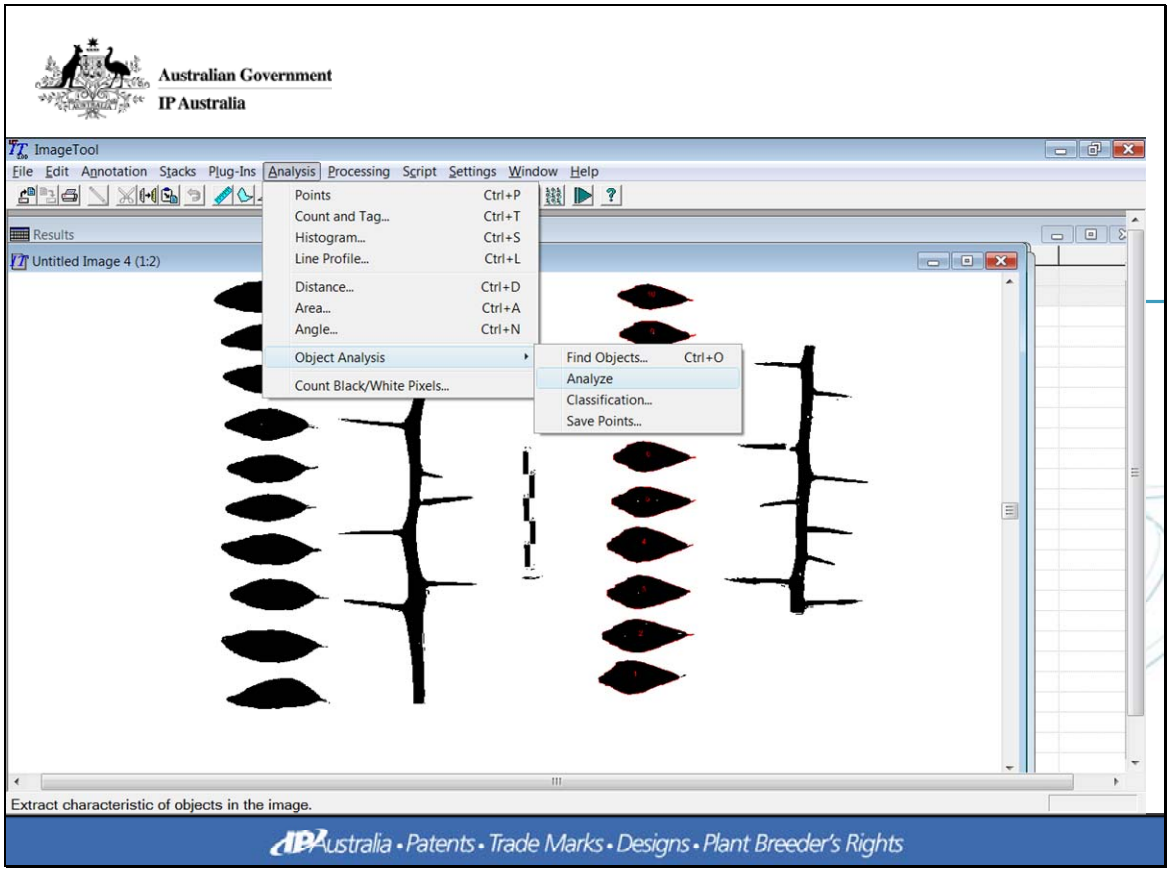
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ImageTool
File Edit Annotation Stacks Plug-Ins Analysis Processing Script Settings Window Help
Points Ctrl+P
Count and Tag... Ctrl+T
Histogram... Ctrl+S
Line Profile... Ctrl+L
Distance... Ctrl+D
Area... Ctrl+A
Angle... Ctrl+N
Object Analysis
Count Black/White Pixels...
Find Objects... Ctrl+O
Analyze
Classification...
Save Points...
Results
Untitled Image 4 (1:2)
Extract characteristic of objects in the image.
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ImageTool - [Results]

File Edit Annotation Stacks Plug-Ins Analysis Processing Script Settings Window Help

	Object	Area	Perimeter	Major Axis Length	Minor Axis Length
Mean		288.69	85.97	34.97	13.31
Std. Dev.		44.89	5.69	2.02	1.56
1	#1	316.11	85.60	34.54	14.72
2	#2	338.64	95.10	39.06	14.34
3	#3	323.87	87.55	35.32	14.55
4	#4	340.17	93.05	36.61	15.47
5	#5	292.58	87.30	35.50	13.22
6	#6	284.96	86.29	34.93	13.41
7	#7	301.37	87.57	35.50	13.60
8	#8	240.61	81.41	33.02	11.33
9	#9	234.48	78.31	32.28	11.52
10	#10	214.12	77.54	32.17	10.97
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Caps Num Play Calibrated Overwrite

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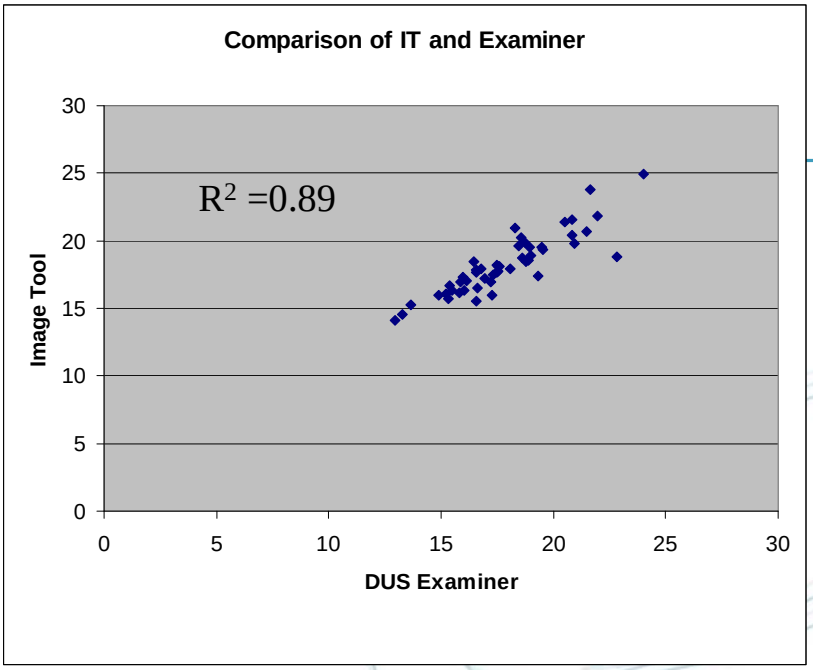

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