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Leaf Characteristics of Apple Dwarfing Rootstocks

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Abstract

Leaf growth varied between 20 apple dwarfing rootstocks growing in the stoolbed. Ottawa 3 rootstock had the largest leaves and MAC 24 the smallest. The more vigorous rootstocks of EMLA, Budagovski and Polish series were recorded in the intermediate size range. This variation in leaf size has an impact upon scion response when grown upon each specific rootstock.

Apple dwarfing rootstocks exhibit varied leaf growth in the nursery stoolbed characteristic to specific rootstocks. These variances were observed when sampling was made for nutrient-element uptake studies (8). Samples were obtained from stoolbed plantings from which rootstocks were selected for the North Central Regional Research Plantings (NC-140) at Oregon Rootstock, INC., Woodburn, Oregon. A leaf sample was collected from 5 separate rootstock layers of each of 20 rootstocks in the stoolbed. The third mature leaf from the shoot apex was sampled and were pressed for size evaluation and recorded by a Richohi copier. Photographs of individual leaves were made and are recorded in Figs. 1-19.

The average leaf size (cm^2) was obtained by using a Program Magic 2 disk Apple 2 Apple Computer. Variations between rootstock leaf size were determined by the use of the Duncan's Multiple Range Test. Acknowledgement is made to Dr. M. C. Chu for statistical analysis.

Leaf size variations are recorded in Tables 1 and 2 and are shown in Figs. 1-19, with the exception of M.4. Specific leaf characteristics including margin, shape, apice, base and stipules are described according to Benson (1).

The data in Table 1 confirm the leaf growth observations that were made on 20 rootstocks in the nursery. Ottawa 3 had the largest leaves and MAC 24 the smallest. Leaf size may not be the indicator of the degree of dwarfing of a specific scion variety. However, leaf development in the rootstock may affect vigor of the compact tree after grafting.

Description of Rootstock Leaves:

MICHIGAN APPLE CLONE

MARK (MAC 9). (Fig. 1) Relative tree size compared to seedling is 40%; introduced by Michigan State University by Dr. Robert F. Carlson as an open pollinated seedling population of M.9; (2, 3, 4, 5) produces trees about the same size as M.9 or slightly larger; very precocious, causing early spreading of tree branches; fruitful and non-suckering; well anchored; propagates well in stoolbeds or in meristem culture.

Leaf characteristics: margin — serrate; shape - ovate to orbiculare, apice — attenuate; base — acute; stipules — thin, narrow, elliptic in shape.

MARK (micro-propagated). (Fig. 2)

Leaf characteristics: margin — serrate; shape — ovate to orbiculate; apice — attenuate; base — acute; stipules — elliptic, prominent, more so than in original MARK.

MAC 24 (Fig. 3) A selection of the Michigan apple clone series (female parent Robusta 5) (2, 3, 4); trees very vigorous, comparable to MM.111 or standard sized trees; growth varies under different soil and climatic conditions; shallow, spreading root sys-

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Table 1. Leaf size comparison of 20 apple dwarfing rootstocks growing in the nursery stoolbed (1984). Average of 5 leaves for each rootstock.

Rootstock	Average leaf size (cm^2)	Significant level[z] .05	.01
Ottawa 3	65.0	a	A
Bud. 9	51.8	b	B
P-22	48.8	b	BC
P-16	48.7	b	BC
MAC 1	41.8	c	CD
EMLA.9	37.5	cd	CDE
EMLA.26	35.0	cde	DE
Bud. 490	34.0	def	DEF
P-1	30.0	efg	EFG
EMLA.106	28.3	efgh	EFG
EMLA.111	26.7	fghi	FG
Bud. 491	26.5	ghi	FG
MARK (micro-propagation)	26.3	ghi	FG
MAC 4	26.2	ghi	FG
M.4	26.0	ghi	FG
EMLA.7	26.0	ghi	FG
MARK	24.1	ghi	G
EMLA.27	22.4	ghi	G
MAC 39	21.4	hi	G
MAC 24	20.6	i	G

[z]Mean separation within columns by Duncan's multiple range test, 5% & 1% levels.

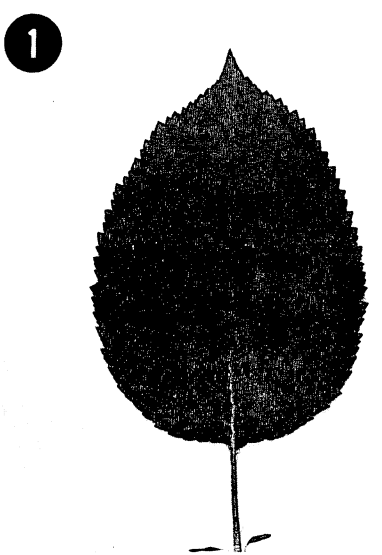

Fig. 1. MARK (MAC 9)

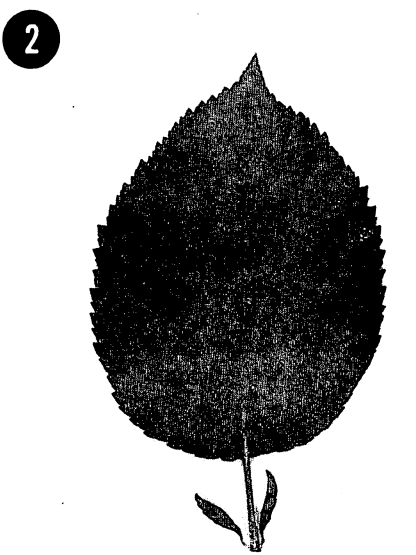

Figure 2. MARK (MAC 9) micro-propagated

tem, well anchored; prone to root suckering.

Leaf characteristics: margin — serrate; shape — ovate to elliptic; apice — attenuate; base — acute; thickness — thin in comparison with other Mac series; stipules — small, narrow, elongated not prominent.

MAC 1. (Fig. 4) Michigan apple clone series, originated from an open pollinated planting of Malling rootstock (female parent M.6) (2, 3, 4); trees approximately EM.7 in size; do not sucker and are well anchored; precocious; productive; disease resistant.

Leaf characteristics: margin - serrate to incised; shape - cordate to ovate; apice — attenuate to acute; base — rounded to cordate; stipules — prominent, elliptic, serrated margins.

MAC 4. (Fig. 5) Malling 13 is the seed parent of this vigorous stock (2, 3, 4).

Leaf characteristics: margin - serrate; shape — obovate apice — attenuate;

Table 2. Average length and width of leaves from 20 apple dwarfing rootstocks (average of 5 leaves).

	Length Cm.	Width Cm.
Ottawa 3	122	76
Bud. 9	107	70
P-22	97	71
P-16	101	67
MAC 1	89	68
EMLA.9	86	60
EMLA.26	78	61
Bud. 490	93	55
P-1	77	55
EMLA.106	78	52
EMLA.111	78	52
Bud. 491	74	52
MARK (micro-propagated)	74	50
MAC 4	73	50
M.4	65	54
EMLA.7	67	53
MARK	71	49
EMLA.27	64	48
MAC 39	69	45
MAC 24	71	49

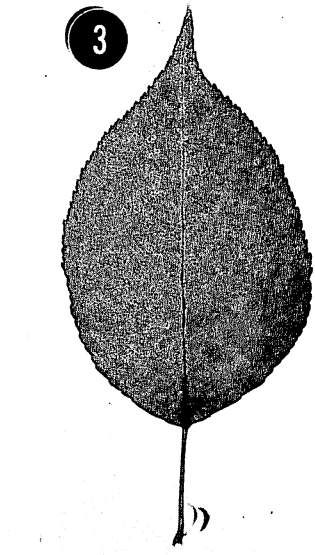

Figure 3. MAC 24

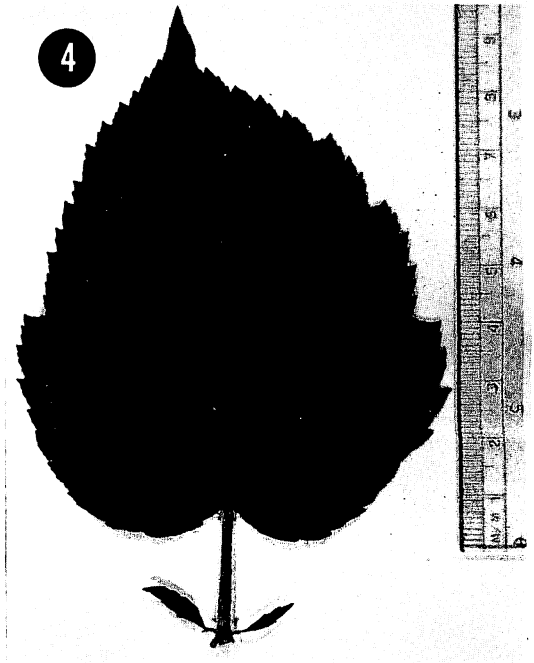

Figure 4. MAC 1

base — acute; stipules — small, elongated, elliptical, slightly serrate margins.

MAC 39. (Fig. 6) Female parent is Malling 2; one of the Michigan apple clone series (2, 3, 4) that produces trees smaller than M.9; very precocious; not well anchored.

Leaf characteristics: margin — incised; shape — ovate; apice — attenuate; base — acute; stipules — prominent with incised margins.

BUDAGOVSKI

Bud 9. (Fig. 7) Originated from a cross of M.8 with Red Standard (named Red Leaved paradise); the clone was named Budagovski 9 or 'B.9' (7); tree size is between M.9 and M.26; requires support or staking; induces early fruiting; is compatible with most cultivars.

Leaf characteristics: margin — crenulate to serrate; shape — roundish, ovate; apice — attenuate; base — obtuse; stipules — small, elliptic, smooth margins.

Bud 490. (Fig. 8) A cross between Budagovski 9 and a hardy rootstock, Budagovski 13-14 (7); trees are comparable to EMLA.106 in vigor; precocious; hardy; well suited for low temperature zones; does not require staking.

Leaf characteristics: margin — serrate; shape — ovate; apice — attenuate; base — acute; stipules — small, elliptic.

Bud 491. (Fig. 9) Produces trees similar to EMLA.27 or EM.9 in size (7); precocious; induces heavy production; well anchored; susceptible to collar rot and fire blight; winter hardy; produces well in the stoolbed.

Leaf characteristics: margin — serrate; shape — ovate; apice — attenuate; base — obtuse; stipules — small, narrow, inconspicuous.

POLISH

P-22. (Fig. 10) A cross between M.9 and Common Antonovka (6, 7); tree size is smaller than M.9, comparable to EMLA.27; resistant to most diseases,

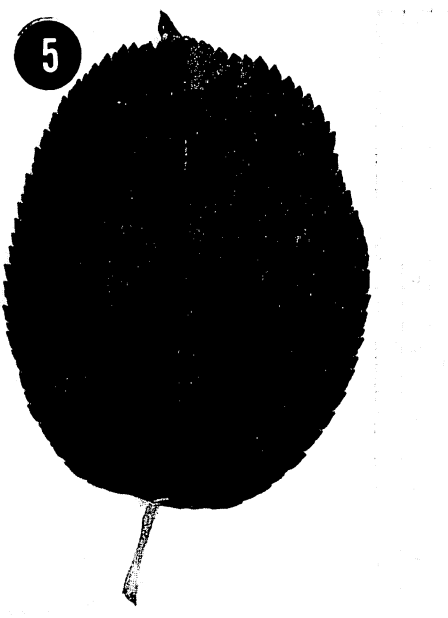

Figure 5. MAC 4

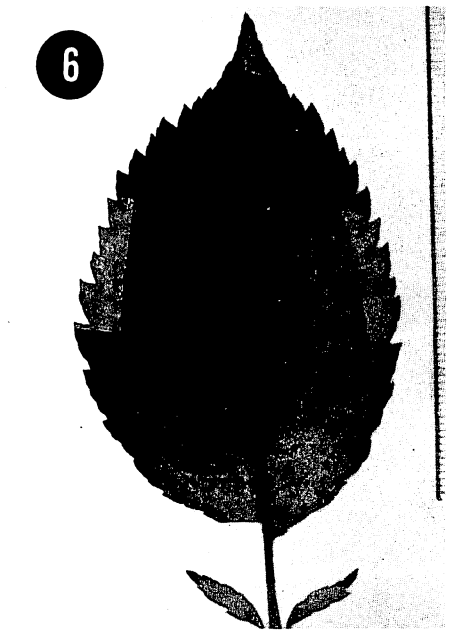

Figure 6. MAC 39

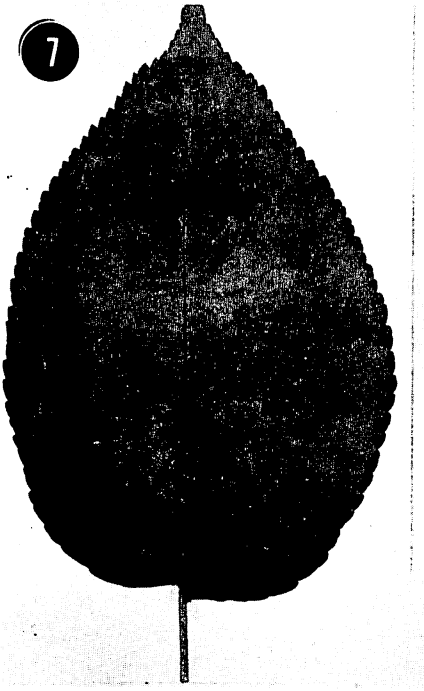

Figure 7. Budagovski 9

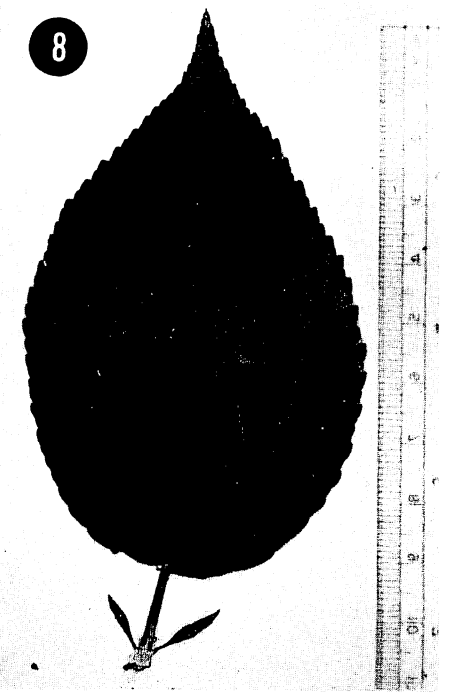

Figure 8. Budagovski 490

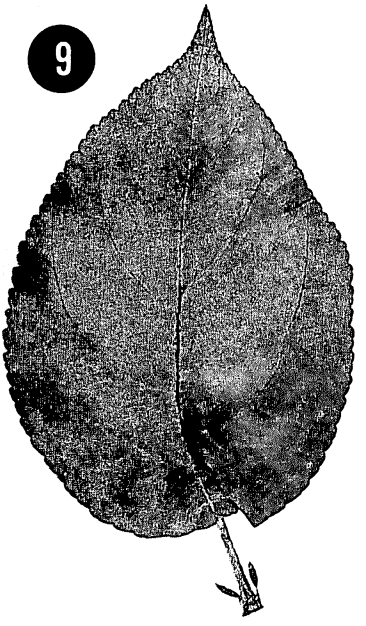

Figure 9. Budagovski 491

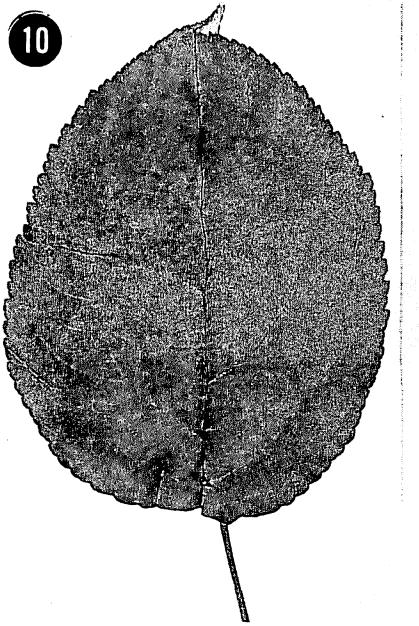

Figure 10. P-22

but susceptible to fire blight and woolly apple aphids; roots well in the stoolbed.

Leaf characteristics: margin — serrate; shape — ovate; apice — attenuate; base — acute; stipules — elliptic, thin, narrow smooth margin.

P-16. (Fig. 11) A cross between M.9 and Common Antonovka (6, 7); produces trees of M.9 size with similar winter hardiness and productive efficiency, but with superior propagation characteristics.

Leaf characteristics: margin — serrate; shape — ovate; apice — attenuate; base — acute; stipules — elliptic, narrow, inconspicuous.

P-1. (Fig. 12) A cross between M.4 and Common Antonovka (6, 7); produces trees that are approximately the size of EMLA.26; requires a rich, well drained soil and does not do well in wet soils.

Leaf characteristics: margin — serrate; shape — ovate; apice — attenuate; base — acute; stipules — small, smooth margins, inconspicuous.

EMLA

EMLA.106

(Fig. 13) A cross between Northern Spy and Malling 1 (6, 7); a virus indexed EMLA clone introduced by East Malling Research Station in 1969-70; trees 65% the size of those on seedling rootstocks; heavy cropping potential; sensitive to soil moisture; susceptible to mildew and collar rot; produces excellent rootstocks in the stoolbed.

Leaf characteristics: margin — serrate; shape — ovate; apice — attenuate; base — obtuse; stipules — prominent, elliptical in shape, slightly serrated.

EMLA.111 (Fig. 14) A cross between Northern Spy and Merton 793 (a Northern Spy and M.2 (Doucin) cross) (6, 7); virus indexed clone introduced by the East Malling Research Station in 1969-70; produces trees that are similar to, but more vigorous than MM.106; adapted to heavy soils with few losses from collar rot; root system well anchored; resistant to woolly aphids;

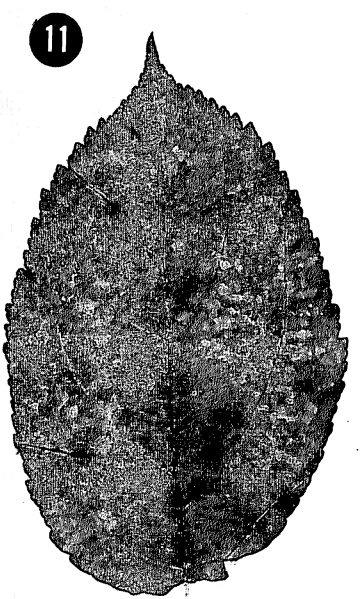

Figure 11. P-16

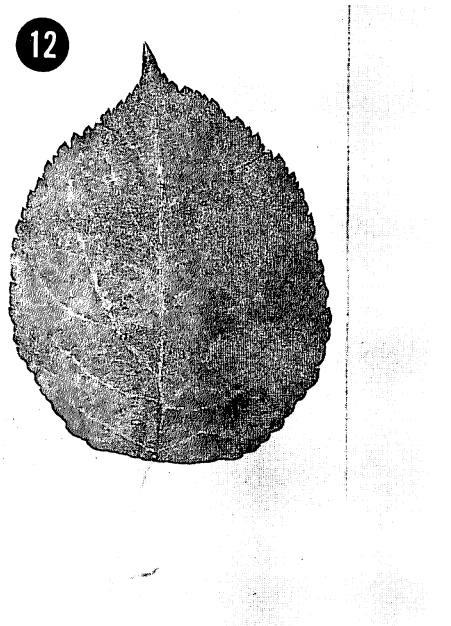

Figure 12. P-1

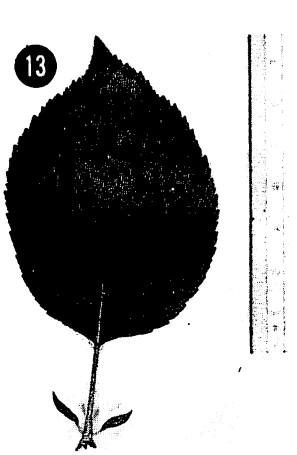

Figure 13. EMLA.106

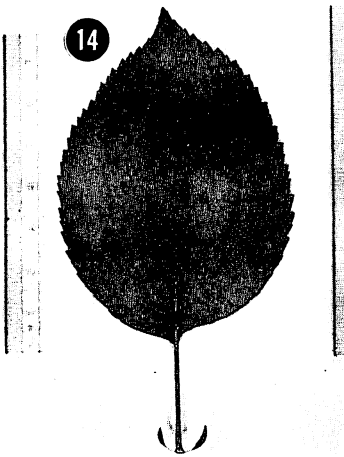

Figure 14. EMLA.111

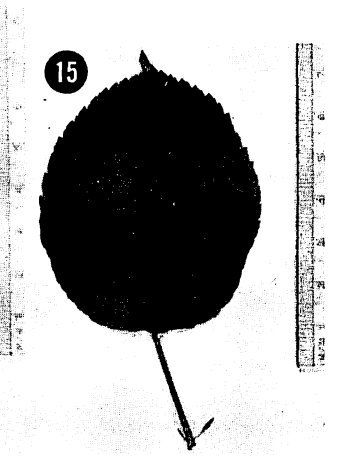

Figure 15. EMLA.7

Figure 16. EMLA.26

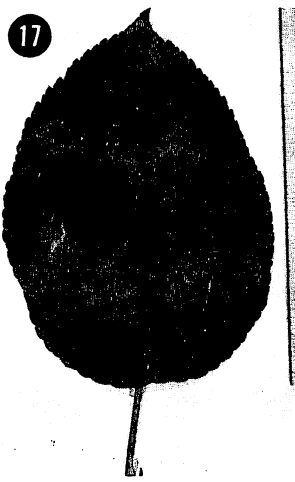

Figure 17. EMLA.9

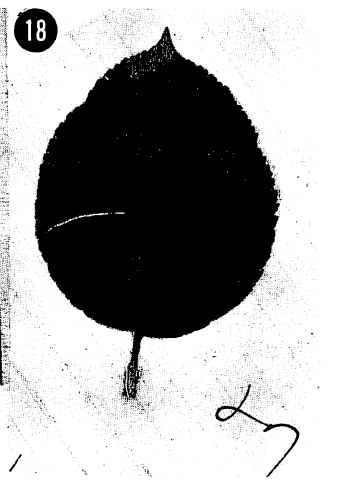

Figure 18. EMLA.27

propagates well in the nursery; some burr knot problems; recommended for vigor control in sandy soils.

Leaf characteristics: margin — serrate; shape — ovate; apice — attenuate; base — obtuse; stipules — small, narrow, inconspicuous.

EMLA.7 (Fig. 15) Selected from French rootstocks known as Doucin; free from economically known viruses (6, 7); moderate resistance to collar rot; produces trees approximately twice the size as M.9; has been successfully tested in commercial production.

Leaf characteristics: margin — serrate; shape — ovate; apice — attenuate; base — obtuse; stipules — very small, inconspicuous.

EMLA.26 (Fig. 16) Malling 26 was selected at the East Malling Research Station in England from a cross between M.9 and M.16 (6, 7); a virus indexed EMLA clone introduced in 1969-70; trees approximately 40% the

size of that on seedling rootstocks.

Leaf characteristics: margin — deeply serrate; shape — ovate; apice — acute; base — truncate; stipules — elliptic, long narrow serrations small and spaced apart on the margin.

EMLA.9 (Fig. 17) Selected at East Malling, England from Juane de Metz and M.9-a in 1962 (6, 7); a replacement clone was developed as EMLA.9 free from latent virus; produces a tree 35% of seedling size.

Leaf characteristics: margin — finely serrated; shape — ovate; apice — acute; base — truncate; stipules — small, narrow, not distinct.

EMLA.27 (Fig. 18) Developed from a cross of Malling 13 (M.13) as a seed parent and EMLA.9 as the pollen parent; trees approximately 50% of EM.9 size

Leaf characteristics: margin — serrate to incised; shape — orbiculate to ovate; apice — acute; base — rounded; stipules — very small, almost indistinct.

MALLING

M.4 Common in Holland and Germany; originally identified as *Malus pumila* (6, 7); sturdy, erect, clean growth in stoolbeds; shoots compact in appearance due to short internodes; makes semi-dwarf to semi-standard tree; recommended for limited use.

Leaf characteristics: margin — serrated, but not deep; shape — ovate; apice — acute; base — truncate; stipules — small, narrow.

OTTAWA

Ottawa 3. (Fig. 19) Originated as a cross of Robin x EM.9; produces trees of EM.9 size or slightly larger, but better anchored than EM.9 (6, 7).

Leaf characteristics: margin — serrate; shape — ovate; apice — acute to attenuate; base — obtuse; stipules — prominent, lanceolate to elliptic in shape.

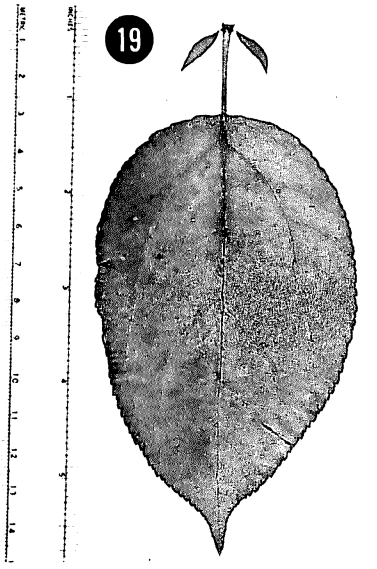

Figure 19. Ottawa 3

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