



- %5 - RXUQDO RI &OLQLFDO 'LDJQRVL 5HVHDUFK

&KRH HW DO - &OLQ 'LDJQ 5
'2,

5HYLHZ

20,&6 ,QWHU

6LPSOH 0ROHFXODU 'LDJQRVWLF 7RROV LQ &O

-DH <RXQJ &KRQJ .XQ DQG +\XQJ 6RR +DQ
'HSDUWPHQW RI 3HGLDWULFV .\XQJSRRN 1DWLRQDO 8QLYHUVLW\ 6FKRRO RI 0HGLFLQH 6RXWK .RUHD
'HSDUWPHQW RI (PHUJHQF\ 0HGLFLQH .\XQJSRRN 1DWLRQDO 8QLYHUVLW\ 6FKRRO RI 0HGLFLQH 6RXWK .
'HSDUWPHQW RI 3K\VLRORJ\ .\XQJSRRN 1DWLRQDO 8QLYHUVLW\ 6FKRRO RI 0HGLFLQH 6RXWK .RUHD
&RUUHVSRRQGLQJ\ 0QWKRQ +DQ 'HSDUWPHQW RI 3K\VLRORJ\ .\XQJSRRN 1DWLRQDO 8QLYHUVLW\ 6FKRRO
6RXWK .RUHD 7HO)D[(PDLO KVKDQ#NQX DF NU
5HFHLYHG - QDWH \$FFHSWHG-XQDWH 3XEOLVKHG XQDWH
&RS\ULJKW &KRH -< HW DO 7KLV LV DQ RSHQ DFFHVV DUWLFOH GLVWULEXWHG XQGHU WKH WHUPV RI
XVH GLVWULEXWLRQ DQG UHSURGXFWLRQ LQ DQ\ PHGLXP SURYLGHG WKH RULJLQDO DXWKRU DQG VRXU

\$EVWUDFW

%DFNJUR\ QGDQFHV LQ JHQHWLF JHQRPLF VVXGLHV KDYH EHHQ D UREXVW GUL
PHGLFLQH SDUWLFXODUO\ LQ WKH GLDJQRVWLF ILHOG \$OWKRXJK DPELWLRXV HII
VKRZQ UHPDUNDEOH SURJUHVW WKHUH DUH QXPHURXV SUDFWLFDO XQPHW QHHGV
JHQRPPLF UHVHDUFK RXWFRPHV IRU SDWLHQW WUHDWPHQW VLPSOH LQH[SHQVLYH

DQG FOLQLFDO NQRZOHGJLJQID)SHD QHWDHE\ MGLQ WKH
GLDJQRVLV DQG PDQDJHPHQW RI GLVHDVHV ,QFRUSRUDWLRQ RI JHQRPLF
PHGLFDO SUDFWLFH H\H\QGYROXWLRQL]HV WKLV

)LVK

),+ LV D F\WRJHQHWLF WHFKQLTXH WKDW KDV EHHQ XVHG VLQFH WKH
dV LV WHFKQLTXH GHWHFW\ MGLQ H\H\QGYROXWLRQL]HV
VHTXHQFH\WXUHV\W\QDWH\WHTXHQFH
RI LQWHUHVW ZLWK D KLJK GHJUHH RI VHTXHQFH FRPSOHPHQWDULW\ ZK
EH GHWHFW\H\H\QGYROXWLRQL]HVFRSH),,+ LV XVHG WR GHWHFW
VSHFLH\WXUHV LQ '1\$ DQG 51\$~\W\QDWH\WHTXHQFH LQ DPQLRWLF
FLUFXODWLQJ WXPRU FHOOV DQG WLVVXH VDPSOHV ,Q PHGLFLQH),,+
XVHG IRU GLDJQRVLV SURJQRVLV HYDOXDWLRQ RU FDQFHU UHPLVV
H[DPLQDWLRQ \$OWKRXJK),,+ KDV EHHQ XVHG DV D PDQXDO F\WRJHQHW

PHWKRG DXWRPDWLRQ E\ FRPSXWHU DVVVLVWHG FRXQWLQJ LV FRPPRQO\ XVHG
DQG FDQ EH LQFRUSRUDPLH\ GL-OS MOKLHF \D\ DQ RACK\ FKLS
IXWXUH

3 & 5

3 & 5 LV D ELRFKHPLFDO WHFKQRORJ\ XVHG WR DPSOLI\ D VHFWRQ RI '1\$
E\ VHYHUDO RUGHUV RI PDJQLWXGH JHQHUDWLQJ WKRXVDQGV WR PLOOLRQV RI
FRSLHV RI D SDUWLFXODU '1\$ VHTXHQFH 3 & 5 LV FRPPRQO\ XVHG LQ FOLQLFV
IRU FDQFHU GLDJQRVLV 3 & 5 DOWRS HDQ\ QRZV IRU UDSLG DQG KLJKO\
GLDJQRVLV RI LQIHFWE\ RXVV GIRVUH DB&H\ GLDJQRVWLF
DSSOLFDWLRQV LQ PLFURELRORJ\ LV LQ WKH GHWHFWLRQ RI LQIHFWRXV DJHQ
DQG GLVFULPLQDWLRQ RI QRQ SDWKRJHQLF IURP SDWKRJHQLF VWUDLQV E\
GHWHFWLQJ WKSHH S\H\ HQ/HHQFHD\ GHWFWLRQ RI LQIHFWRXV
SDWKRJHQB JL\ W\H\ VQS\ K\W\ O\ D\ Q\ L\ P\ H\ LQ WUHDWPHQW 3 & 5
EDVHG '1\$ TXDQWLWDWLRQ WHFKQLTXHV DUH DOVR XVHG WR PHDVXUH YLUDO
ORDG

HU\DUH QXPHURXV YDULDWLRQV RI 3 & 5 WHFKQLTXHV WKDW DUH XVHG IRU
GHGLFDWHG SXUSRV\ H\O\ 3\SSUE\ M\ ID PCSLOH\ Q\B\ VWLF
WHFKQLTXH EDVHG RQ VLQJOH\ PQSKOFQ\ B\ WL\ B\ YDULDWLRQV 3 & 5
XQGHU VWULQJHQW F\H\ Q\ B\ H\ Q\ R\ Q\ K\ H\ S\ U\ P\ H\ V\ H\ Q\ D\ H\ V\ R\ M\ D
PLVPDWFK EHWWHHQ D WHPSODWH DQG SULPHU DQG WKXV VXFFHVVIXO
DPSOL\ F\Z\ W\K\ R\ Q\ V\ L\ Q\ J\ O\ H\ Q\ X\ F\ O\ H\ R\ W\ L\ C\ S\ H\ S\ R\ Q\ P\ R\ U\ S\ K\ L\ V\ P\
SULPHU LQGLFDWHW SHKA\ 1\ S\ U\ L\ H\ Q\ HDQF\ H\ T\ R\ H\ Q\ K\ H\

OLFURDUUD\

\$ PLFURDUUD\ LV D PXOWLSON[GLPHQVLRQDO DVVD\ IDEULFDWHG RQ D
JODVV RU VLOLFRQ VXEVVUDWH ZKLFK GHWHFWV ODUJH DPRXQWV RI ELRORJL
PDWHULDO DQG LV XVHG DV D KLJK WKURXJKSXW VFUHHQLQJ V\WHP :LWK WKH
HVWDEOLVKPHHQW RI JHQH \$F\K\ R\ S\ W\ S\ L\ B\ Q\ M\ H\ V\ VXFK DV
\$SSOLHG OLFURDUUD\ \$UUD\ LW DQG ,OOXPLQD '1\$ PLFURDUUD\
WHFKQRORJ\ KDV EHFRPH YHU\ VRSKLVWLFDWG DQG ZLGH\ XVHG LQ PHGLFDO
DSSOLFDWLRQV VXFKS\ DR\ Q\ B\ Q\ H\ G\ H\ V\ W\ L\ R\ Q\ D\ Q\ G\
FRS\ QXPEHU DQDO\VLV DPRQJ RWKHUV > @

0DVV VSHFWURPHWU\ RI '1\$

\$QDO\VLV RI '1\$ E\ VSHFWURPHWU\ LV DFKLHYHG E\ SHUIRUPLOQJ WKH
IROORZLQJ SURFHVVHV FU\WDOOL]DWLRQ RI WKH 3 & 5 SURGXFW LRQL]DWLRQ F
FU\WDO E\ ODVHU DQG LRQ GHWHFWLRQ EDVHG RQ SURGXFW PDVV \$V VPDOOH
PROHFXOHV WUDYH\ H\ F\ R\ V\ (20)J\ T\ J\ 6\ F\ 5\ 10\ T\ D\ 1\ U\ Q\ (30)625983HD\ T\ D\ (30)P\ 2\ ((W)6\ 6\ H\ 5\ K\ F\ -W\ 4\ 6\ -4\ (R\ 2\ B\ (Q\ -5\ P\ 8\ (9\ M\)-

3RLQW RI FDUH WHVWLQJ