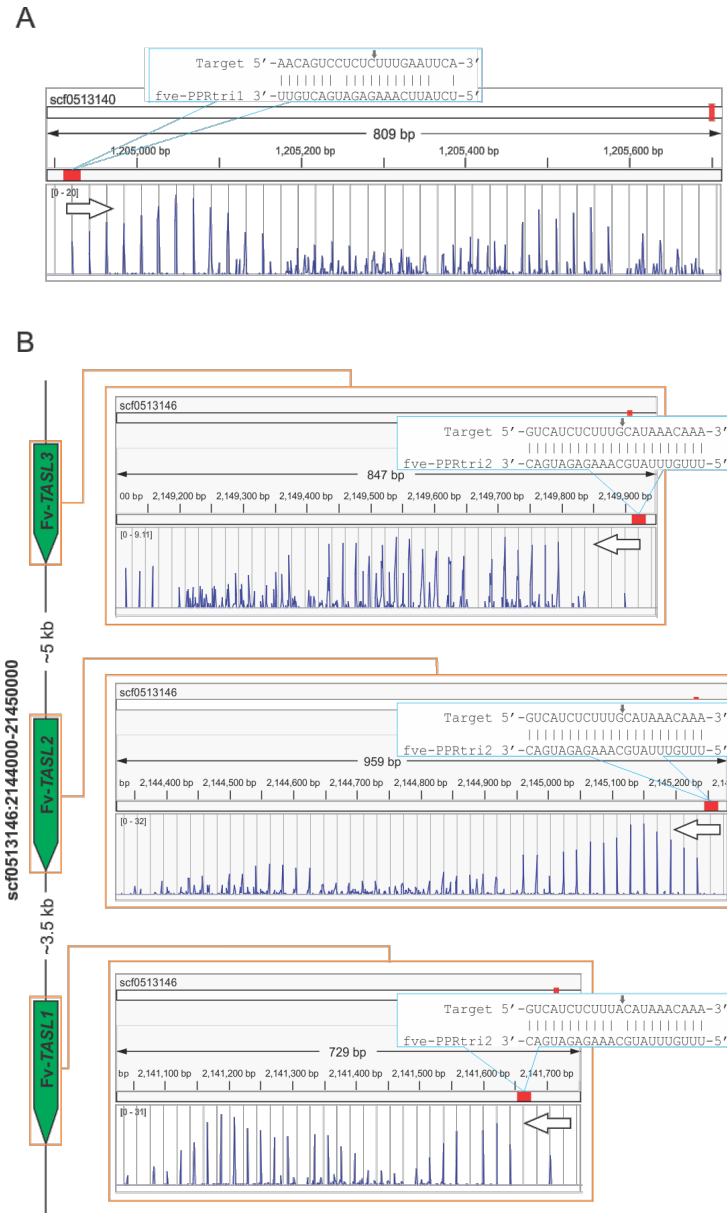


**Supplemental Figure 1. siRNA distribution along *Pp-TASL1/2*, a peach *PPR* gene and *Md-TASL1***

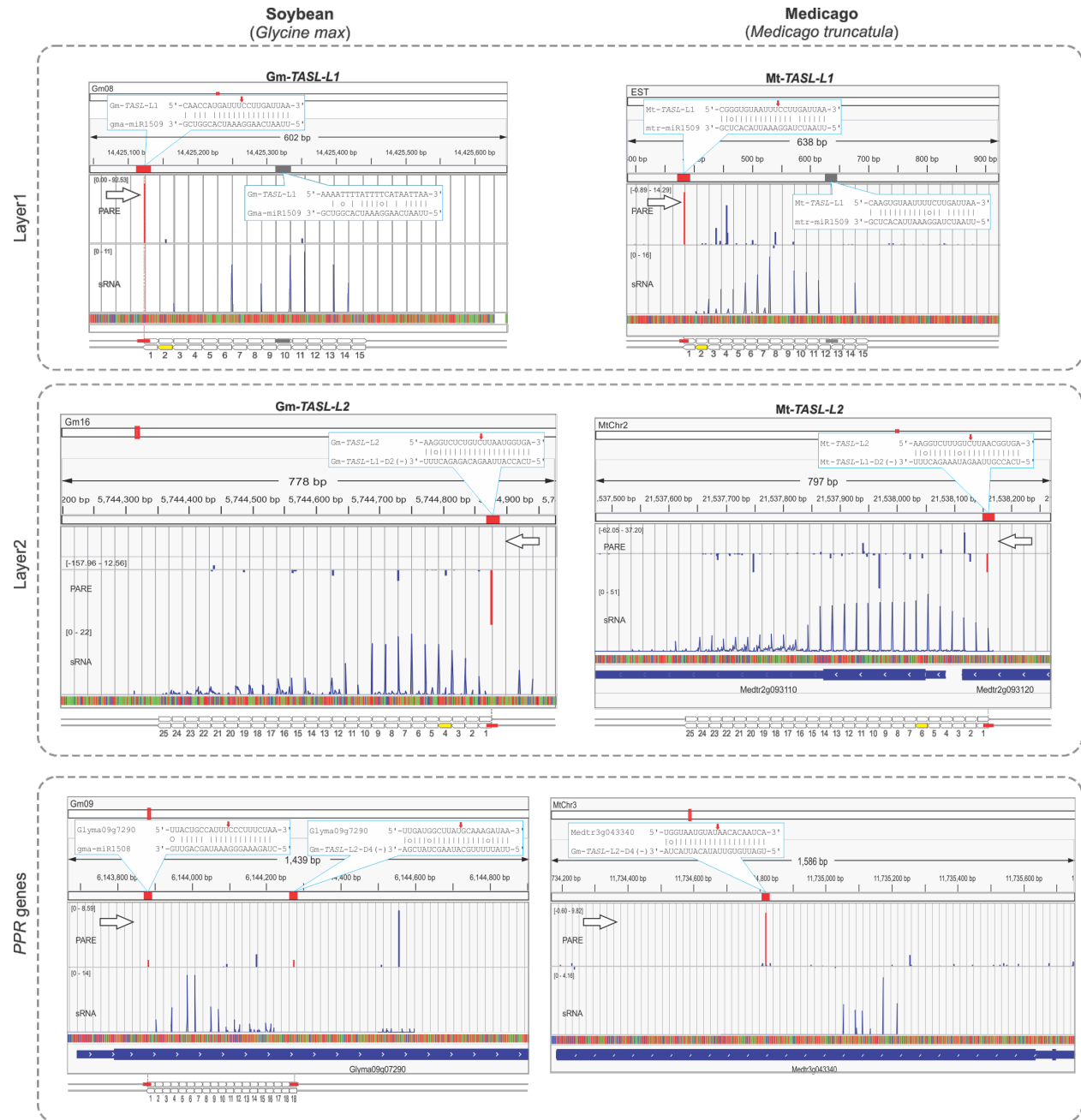
**(A/C)** Dot plots and radar charts illustrating the siRNA production of *Pp-TASL1/2* (A) and *Md-TASL1* (C). Target sites of miR7122 are indicated by small black arrows. Radar chart displays the abundance of reads corresponding to each of the 21 possible phasing registers, with the 5' end of the miRNA trigger guided cleavage of the target site defined as register 1. The total number of small RNAs mapping to that register is plotted as relative distance from the center. The transcript direction is denoted by large arrows at the upper-right corner.

**(B)** Phasing score distribution along a peach *PHAS* PPR gene (*ppa027230m*). Pairings of miRNA or tasiRNA and their target sites are denoted; grey gridlines show the 21-nt phasing pattern set up by the cleavage site of the *Pp-TASL1-D2*(-). A diagram showing the siRNA production pattern after the potential cleavage guided by the *Pp-TASL1-D2*(-) is included below.



**Supplemental Figure 2. The miRNA-TASL-PPR-siRNA pathway is conserved in strawberry**

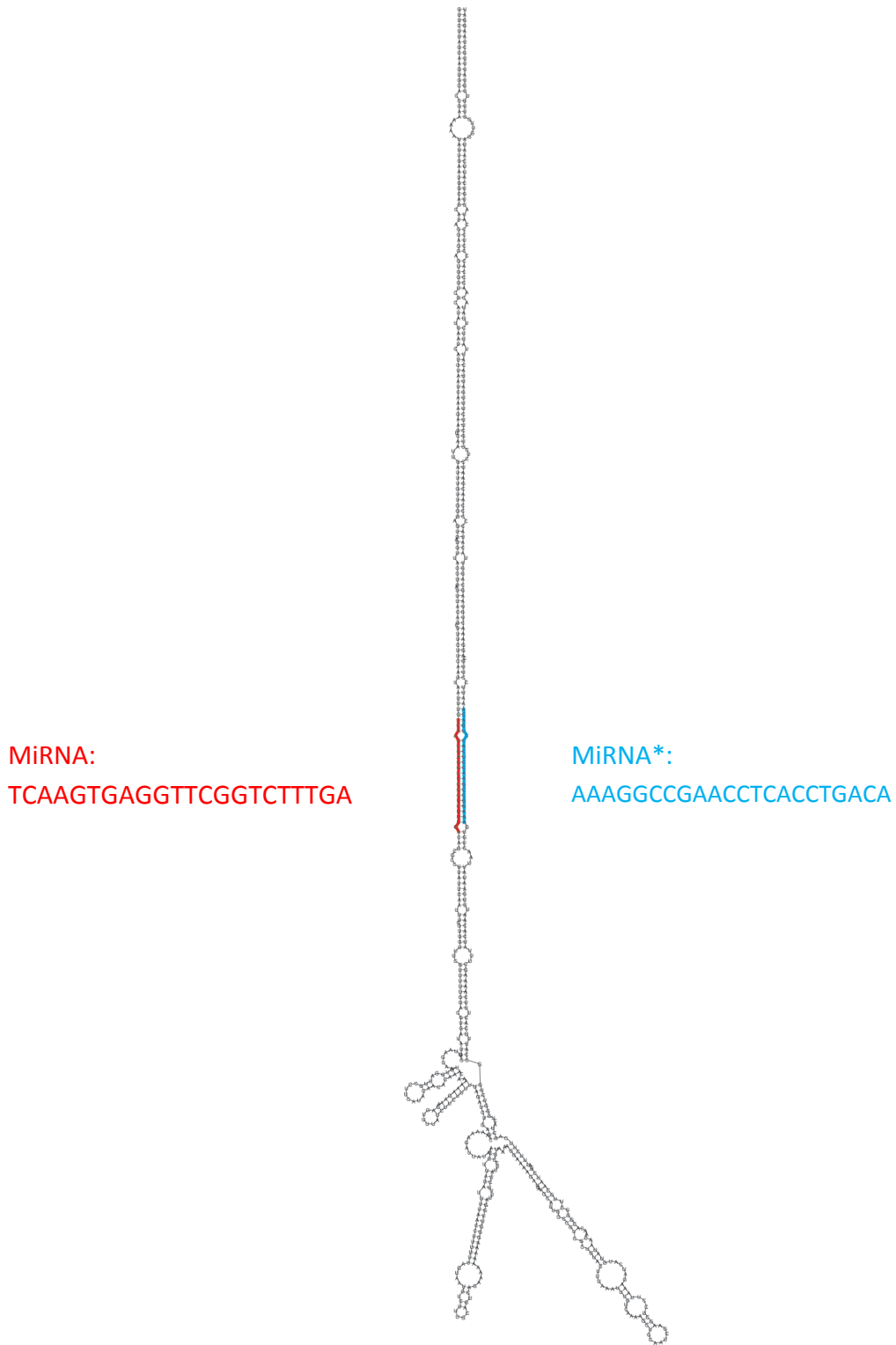
Phasing score distribution along a *PHAS PPR* gene (A) and three *TAS*-like loci (B) in strawberry. Pairings of fve-PPRtri1 or 2 and target sites are indicated correspondingly; genomic configuration of three *TAS*-like loci is denoted on the right of panel B; grey gridlines show the 21-nt phasing pattern set up by the cleavage site of fve-PPRtri1 or 2. The transcript direction is denoted by large arrows on the left or right side.



**Supplemental Figure 3. Two layers of trans-acting interaction involved in the miR1509-TASL-PPR-siRNA pathway in soybean and Medicago.**

Phasing score distribution along *TASL-L1s*, *TASL-L2s* and *PPRs* are viewed together with PARE data in IGV. Parings of the trigger (miRNA or tasiRNA) and the target site are denoted for each gene with cleavage site marked with a small red arrow; grey gridline show the 21-nt phasing pattern set up by the cleavage site of the corresponding trigger. Uncleaved target site of *TASL-L1s* are indicated in grey boxes. Diagrams showing the siRNA production pattern after the cleavage guided by trigger miRNAs or tasiRNAs are included below; tasiRNAs serving as triggers of next-layer *TASL* or *PPR* genes are highlighted in yellow. Red bars in the PARE data track indicates the values corresponding to the cleavage site of trigger miRNAs or tasiRNAs. The transcript direction is denoted by large arrows on the left or right side.

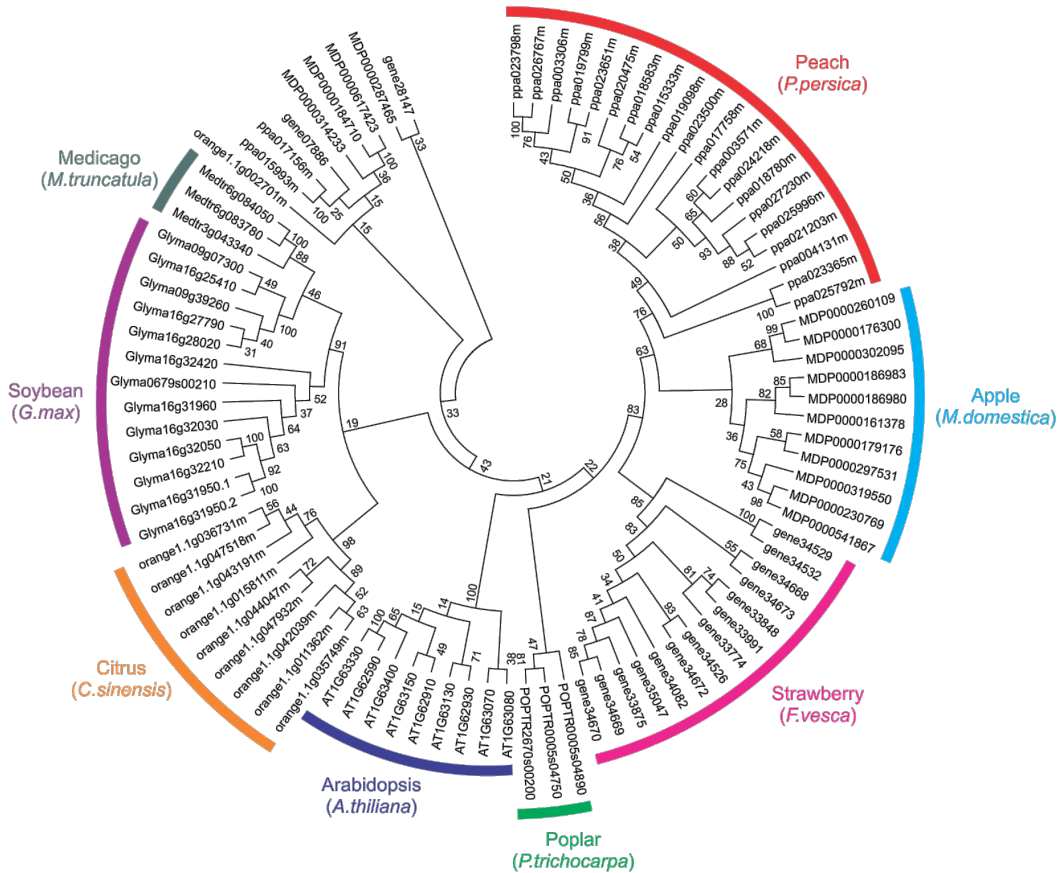




**Supplemental Figure 5. Stem-loop structure of miRC1 in citrus.**

Stem-loop structure was produced by RNAfold. MiRNA and miRNA\* are highlighted with red and light-blue lines, respectively, with their corresponding sequences denoted beside.

A



B



### Supplemental Figure 6. Phylogenetic analysis of *PPR* genes and distribution of target sites of miRNAs or tasiRNAs along *PPR* domains.

(A) Phylogenetic analysis of *PPR* genes identified in various plants. Multiple alignment of *PPR* genes was performed with Clustalw2 with default settings with alignment results shown in Supplemental Data set 3 online. Phylogenetic tree analysis for *PPR* genes was conducted using the neighbor-joining method by MEGA5. The bootstrap consensus tree inferred from 1000 replicates is taken to represent the evolutionary history of the taxa analyzed. Branches corresponding to partitions reproduced in less than 50% bootstrap replicates are collapsed. The evolutionary distances were computed using the Poisson correction method and are in the units of the number of amino acid substitutions per site. The analysis involved 91 amino acid sequences. All positions with less than 50% site coverage were eliminated. There were a total of 560 positions in the final dataset.

(B) Distribution of target sites of miRNAs or tasiRNAs along *PPR* repeats. Target sites of miRNAs or tasiRNAs are marked in yellow.

***Picea abies***

**Pab-miR391 (23 bp)**

Initial  $\Delta G = -58.10$

```

      10      20      30      40      50
|  A      G      C      U      AU      C      -      C      C
GGUU AGUGG UUUC UUCGCAGGA AG GGCG CGGCCU CU AUCUGG A
CCAA UCGCC AAAG AAGCGUCCU UC CCGC GCCGGA GA UGGACU G
^  C      A      -      U      --      A      C      -      G
.      90      80      70      60
    
```

***Amborella trichophoda***

**Atr-miR4376a (22 bp)**

Initial  $\Delta G = -57.40$

```

      10      20      30      40      50      60      70
AA UA GAGA-| C G U CUG A GA AUA UUA
GAUAA GUG GA GAGAG AU GA GAAG UU UUG UCACAG GAGAUGAUACUGGU UG UAGA C
CUGUU UAC CU CUCUC UA CU UUUC AA AACAGUGUC CUCUACUAUGACCAAC AUCU U
AC UA ACCAA^ C A - UA- C G- AA- UGU
150 140 130 120 110 100 90 80
    
```

**Atr-miR4376b (21 bp)**

Initial  $\Delta G = -55.90$

```

      10      20      30      40
U C- U UC A---| UC
GAU GGAU UCCC GC AGGAGAGAUGAUGCCGGCCA UC \
CUA CCUA AGGG CG UCUUCUCUACUACGGCCGGU AG U
C CC C GA ACAC^ UC
90 80 70 60 50
    
```

***Panicum virgatum***

**Pvi-miR1432 (22 bp)**

Initial  $\Delta G = -63.50$

```

      10      20      30      40      50
C A C A AUG GC - --| G
GUG GUCCU AG UCAGG GAGAUGACACCG UCGGACGG CGAU CG AGAU U
UAC CAGGA UC AGUCC CUUUACUGUGGC AGCCUGCC GCUG GU UCUA G
C C A C CGG UA U CG^ C
110 100 90 80 70 60
    
```

***Hordeum vulgare***

**hvu-miR1432 (21 bp)**

Initial  $\Delta G = -66.00$

```

      10      20      30      40      50
| GGUCCUGUGU AGA G UCGAU G GC A
GGGUCCUGUGU UCAGG GAUGACACC ACA CGGAUG GUCG UGGCUU A
CUCGGGAUACAAGUCC CUACUGUGG UGU GCCUAU UAGU ACCGGA C
^  GCC A UU--- G -- U
.      100      90      80      70      60
    
```

**Mimulus guttatus**

**Mgu-miR5225 (22 bp)**

Initial  $\Delta G = -54.90$

```

      10      20      30      40
G      A      CU--|      CUU
GU GCGUCGCGAGGAGAGAUG CACUUGAU ACUUUCC \
CA CGCGGCGUCCUCUCUGC GUGGGCUA UGAAAGG U
      G      C      ACUU^      UCG
      80      70      60      50
    
```

**Nicotiana tabacum**

**Nta-miR3627 (22 bp)**

Initial  $\Delta G = -58.10$

```

      10      20      30      40      50
G GG A G U CU U CA ---| AA
AA GG AUUG GGG GUC UGUCC GGAGAGA GGCACUUAG UUCUAU UGGU \
UU UC UAAC CCC UAG ACAGC UC UUUCU CCGUGAAUC AAGGUA ACCG A
      G UU A G C UU - C- AAA^ UA
      110      100      90      80      70      60
    
```

**Solanum lycopersicum**

**Sly-miR3627**

Initial  $\Delta G = -46.70$

```

      10      20      30      40      50      60
A A U C G U CCA--| U AUU AC
AGAGAUUG GGG AUC UG UCG AGGA AGA GGCACUUG UUCU UUUA GGU \
UCUUUAAC CUC UAG ACAGC UUCU UCU CCGUGAAU AAGG AAU CCG A
      A G C U G - UAACC^ U --- UA
      110      100      90      80      70
    
```

**Vitis vinifera**

**Vvi-miR4376 (22 bp)**

Initial  $\Delta G = -54.10$

```

      10      20      30      40      50
U--| GA CU UC C CGU CAU AU
GCA GAAAGGUU CU GCAGGAGAGAUGA GC CGCC GUCC U
UGU CUUUCCAA GA CGUCCUCUUUACU CG GCGG CGGG C
AUG^ A- AG UA A ACC AU- AG
      100      90      80      70      60
    
```

**Vvi-miR5225 (22 bp)**

Initial  $\Delta G = -57.00$

```

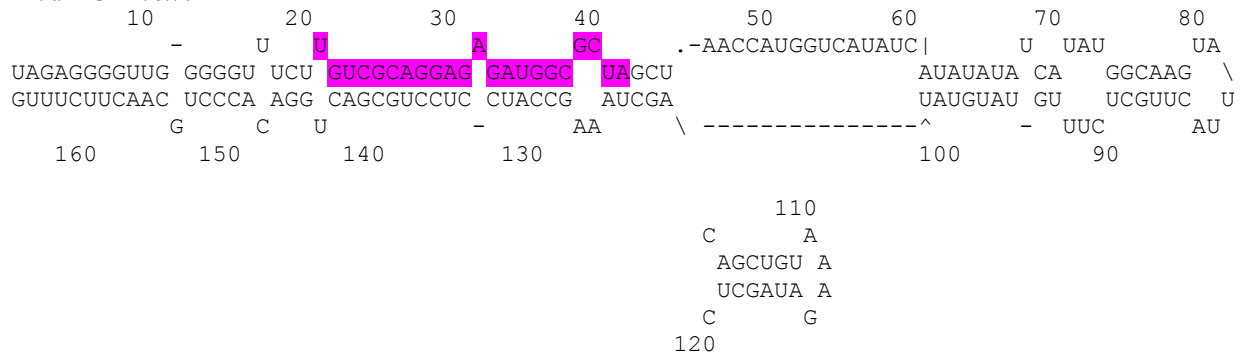
      10      20      30      40      50
GA GG-----| C A C UGAGCUG
GGAGGGAGG GGGAG CUGGUG UC CAGG GAGAUGG ACCUGC UU U
CUUCCUUUCU UCUUC GACUACAG GUCC CUCUACU UGGACGAA G
AA AUCGUCGUA^ A - U UUAGUUA
      110      100      90      80      70      60
    
```



**Populus trichocarpa**

**Ptr-miR3627 (22 bp)**

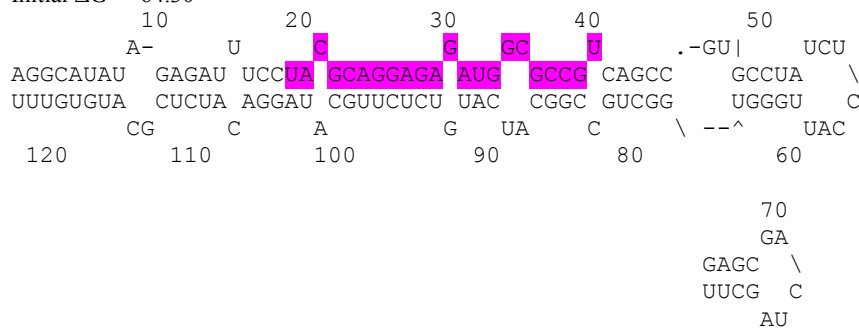
Initial  $\Delta G = -78.70$



**Carica papaya**

**Cpa-miR4376 (22 bp)**

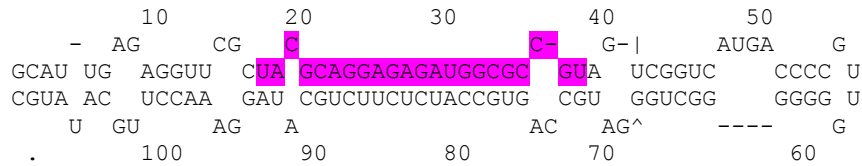
Initial  $\Delta G = -64.30$



**Prunus persica**

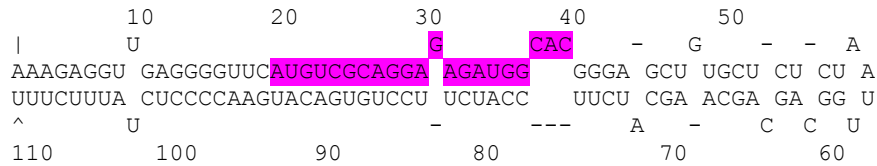
**Ppe-miR4376 (22 bp)**

Initial  $\Delta G = -59.10$



**Ppe-miR3627a (21 bp)**

Initial  $\Delta G = -65.00$



**Ppe-miR3627b (*Prunus persica*, 22 bp)**

Initial  $\Delta G = -58.10$

```

      10      20      30      40      50
      -  A  A  U      A      -  -| AA
AAGUUG AGGG UUU UG UCGCAGGAG GAUGGCACUGUCUG UGGU GC \
UUCAAU UCCC AAA AC AGUGUCCUC CUACUGUGGUAGAC ACCA CG C
      A  A  G  C      C      G  U^ AU
      100      90      80      70      60
    
```

***Fragaria vesca***

**Fve-miR3627a (22bp)**

Initial  $\Delta G = -68.50$

```

      10      20      30      40      50      60
      ---- AUC      A      UAC      -  -A|      CGAGA
AAGAGUU  GGA  CUG UCGCAGGAG GAUGGCAC  CUAGCU UUACGC  UACGUAC  U
UUCUUCAA  CCU  GACAGUGUCCUC CUACCGUG  GAUCGA GAUGUG  GUGCAUG  A
      CGUC  AAU      -      UUC  C  \  -^      CAUAU
      150      140      130      120      110      70

      80      90
      GUAAAUUAU  AU
      AUAG  \
      UAUC  G
      GUAGU----- GA
      100
    
```

**Fve-miR3627b (22bp)**

Initial  $\Delta G = -70.20$

```

      10      20      30      40      50      60      70
      |  AUU  A      A      U  G  AAGUA  AUC      AU-  CA
AAGAG  GAGGG UUC UAUGUCGAGGAG GAUGG  AC  UGC  GCU  UGUUAUAUAUAGGAU  AUG  \
UUUUC  CUCCC AAGAUACAGUGUCCUC CUACC  UGU  ACG  CGA  AUAUAUAUGUAUCUUG  UAC  U
      ^  GAC  A      -      U  -  A----  GA-      ACU  CG
      140      130      120      110      100      90      80
    
```

**Fve-miR3627c (22bp)**

Initial  $\Delta G = -80.40$

```

      10      20      30      40      50      60      70
      A-  A  GUC      A      -AG  GUU      A  U--|      C
AAGAGUU  AG  GA  CUGUCGAGGAG GAUGGCACGAGCU  CUA  UGUUAUAUGU  UGCU  UACGUAU  G
UUCUUCAA  UC  CU  GACAGUGUUCUC CUACCGUGUUCGA  GAU  AUAUAUAUA  AUGG  AUGCAUA  A
      CG  C  AAU      -      \  --  AC-      A  UCC^      G
      170      160      150      140      100      90      80

      110      120
      AAGA      AU
      GCUGUUG  G
      CGACGAU  G
      C---      GU
      130
    
```

**Fve-miR5225 (22bp)**

Initial  $\Delta G = -68.50$

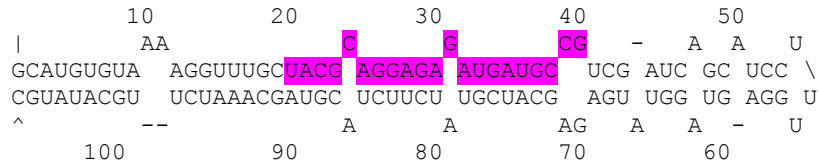
```

      10      20      30      40      50      60      70      80
      AGA-|  CG  U  A  U      U      AAA      UGAU  UGAUU  A  U
GAGAG  GAUCGA  CG  AGGG  CUUC  GUCC  AGGAGAGAUGGCCCC  UGUUAUGA  UAC  GU  UAUGA  \
CUUUC  UUAGCU  GC  UCCC  GAAG  CAGC  UUCUCUCUACUGCGG  GCGUACU  AUG  CG  AUAUU  G
      AGAC^  AG  -  C  U  -      GUG      UAU-  UCAU-  -  U
      150      140      130      120      110      100      90
    
```

### *Medicago truncatula*

#### Mtr-miR391 (21 bp)

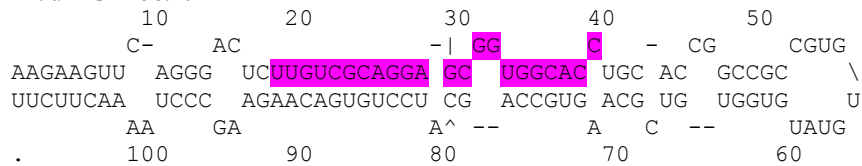
Initial  $\Delta G = -52.20$



### *Citrus sinensis*

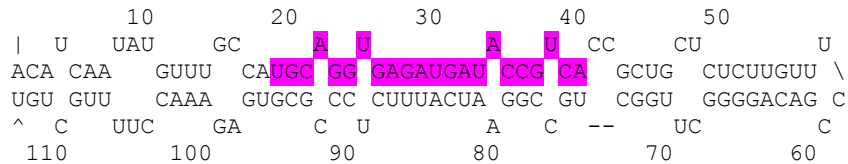
#### Csi-miR3627 (22 bp)

Initial  $\Delta G = -58.40$



#### Csi-miR5225 (22 bp)

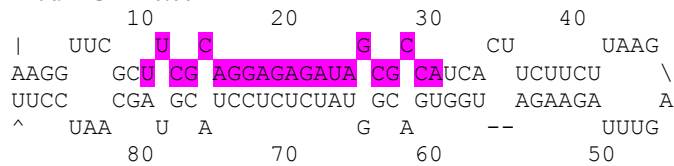
Initial  $\Delta G = -41.30$



### *Brassica nap*

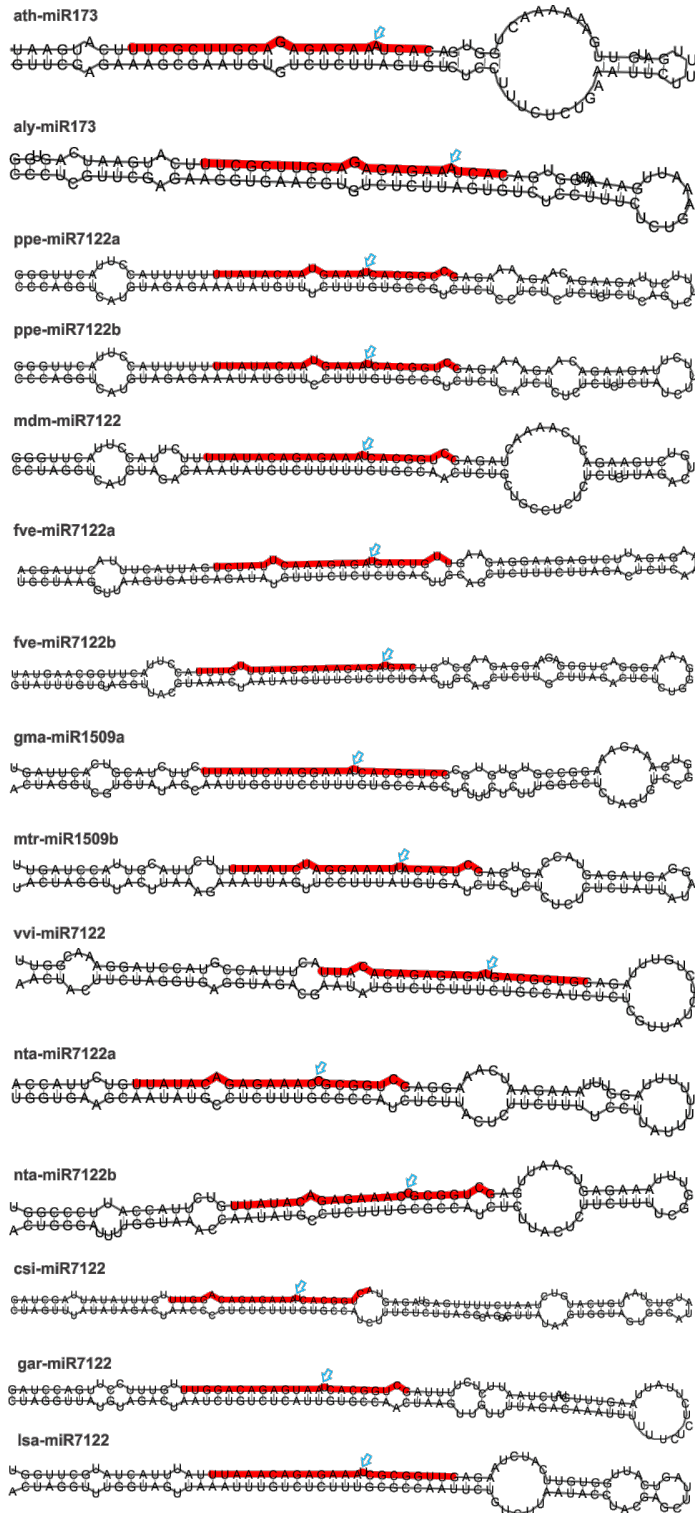
#### Bna-miR391 (21 bp)

Initial  $\Delta G = -40.00$



### Supplemental Figure 7. Stem-loop structures of newly identified miRNA homologues of the miR4376 superfamily.

Structures were predicted using Mfold. MiRNA names were assigned according to the most similar miRNA hit retrieved by BLAST searches of the new miRNA sequence against miRbase (version 19). Mature miRNAs are highlighted in pink.



**Supplemental Figure 8. Stem-loop structures of identified *MIR7122* homologues.**

Stem-loop structures were produced by RNAfold. Mature miRNAs are marked with red lines; positions of bulges in miRNA/miRNA\* duplex are indicated with light-blue arrows.