In [27]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
from sklearn import datasets
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import make_scorer, accuracy_score,precision_score
from sklearn.metrics import classification_report
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score ,precision_score,recall_score,f1_sc
ore
```

In [28]:
```
df = pd.read_csv('Iris.csv')
```

In [29]:
```
df.head()
```

Out[29]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa
4	5	5.0	3.6	1.4	0.2	Iris-setosa

In [30]:
```
df.tail()
```

Out[30]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
145	146	6.7	3.0	5.2	2.3	Iris-virginica
146	147	6.3	2.5	5.0	1.9	Iris-virginica
147	148	6.5	3.0	5.2	2.0	Iris-virginica
148	149	6.2	3.4	5.4	2.3	Iris-virginica
149	150	5.9	3.0	5.1	1.8	Iris-virginica

In [31]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 6 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   Id             150 non-null    int64  
 1   SepalLengthCm  150 non-null    float64
 2   SepalWidthCm   150 non-null    float64
 3   PetalLengthCm  150 non-null    float64
 4   PetalWidthCm   150 non-null    float64
 5   Species        150 non-null    object 
dtypes: float64(4), int64(1), object(1)
memory usage: 7.2+ KB
```

In [32]:
```
df.describe()
```

Out[32]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm
count	150.000000	150.000000	150.000000	150.000000	150.000000
mean	75.500000	5.843333	3.054000	3.758667	1.198667
std	43.445368	0.828066	0.433594	1.764420	0.763161
min	1.000000	4.300000	2.000000	1.000000	0.100000
25%	38.250000	5.100000	2.800000	1.600000	0.300000
50%	75.500000	5.800000	3.000000	4.350000	1.300000
75%	112.750000	6.400000	3.300000	5.100000	1.800000
max	150.000000	7.900000	4.400000	6.900000	2.500000

In [33]:
```
df.isnull().sum()
```

Out[33]:
```
Id               0
SepalLengthCm    0
SepalWidthCm     0
PetalLengthCm    0
PetalWidthCm     0
Species          0
dtype: int64
```

In [34]:
```
df = df.drop(columns= ['Id'])
df.head()
```

Out[34]:

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	5.1	3.5	1.4	0.2	Iris-setosa
1	4.9	3.0	1.4	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa
3	4.6	3.1	1.5	0.2	Iris-setosa
4	5.0	3.6	1.4	0.2	Iris-setosa

In [35]:
```
df.describe()
```

Out[35]:

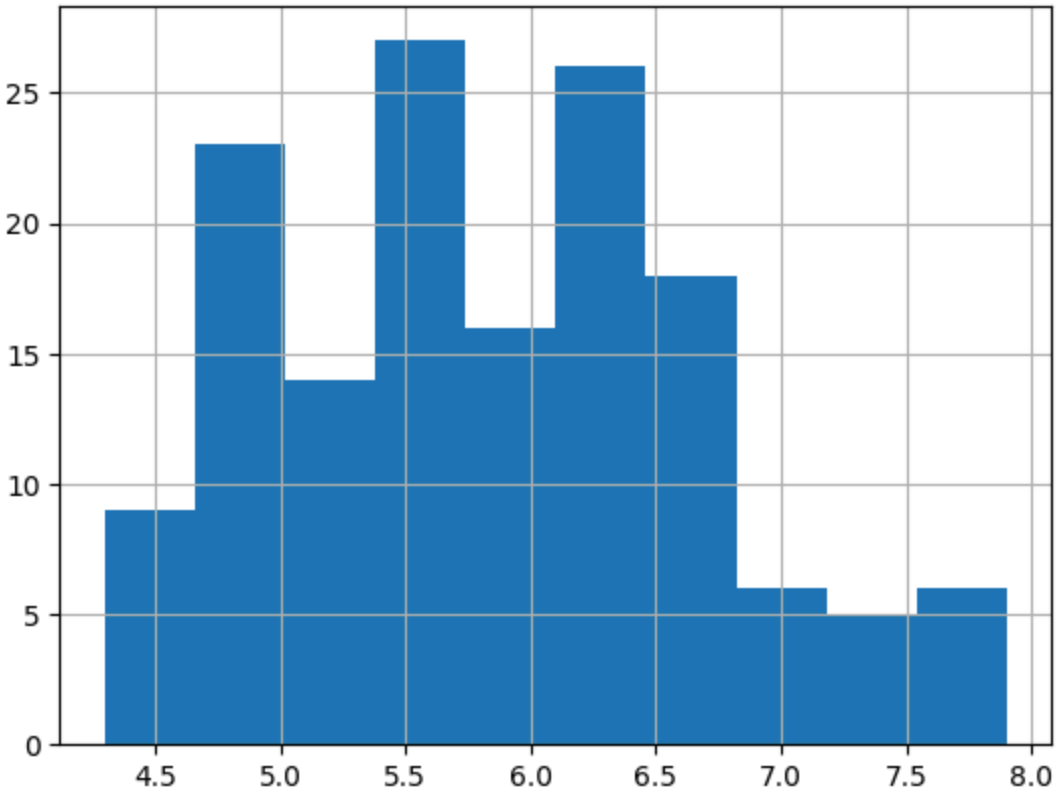
	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm
count	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.054000	3.758667	1.198667
std	0.828066	0.433594	1.764420	0.763161
min	4.300000	2.000000	1.000000	0.100000
25%	5.100000	2.800000	1.600000	0.300000
50%	5.800000	3.000000	4.350000	1.300000
75%	6.400000	3.300000	5.100000	1.800000
max	7.900000	4.400000	6.900000	2.500000

In [36]:
```
df['Species'].value_counts()
```

Out[36]:
```
Species
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
Name: count, dtype: int64
```

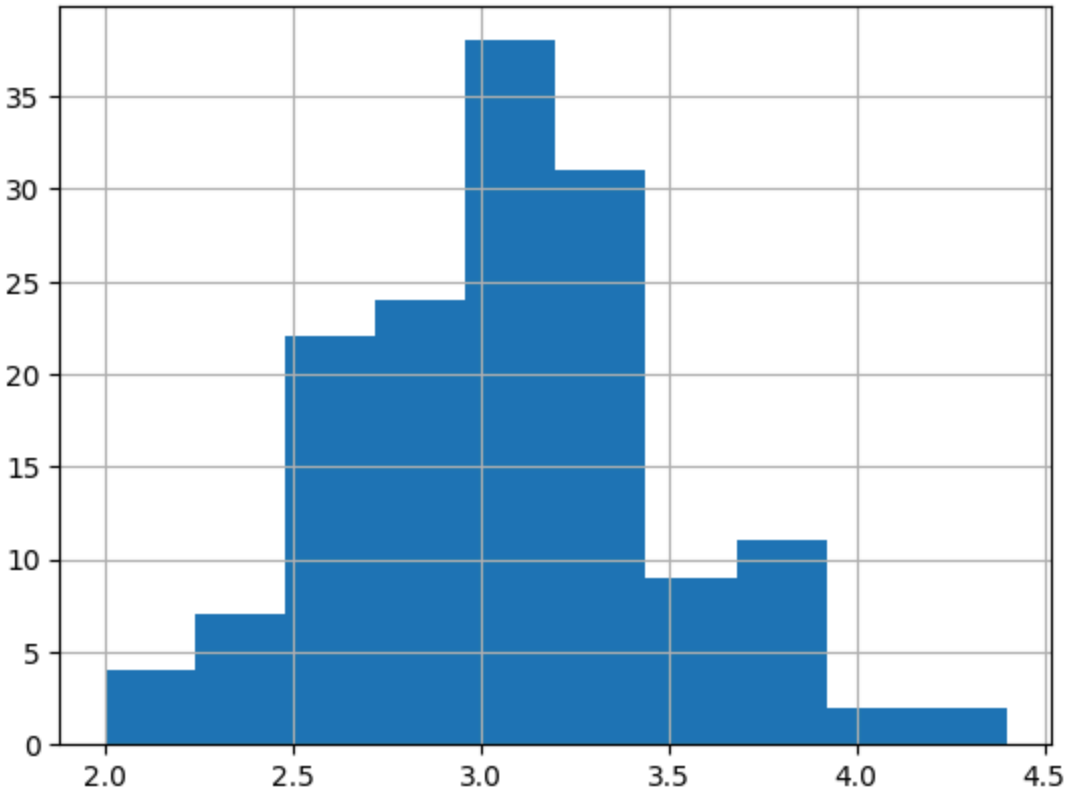
In [37]:
```
df['SepalLengthCm'].hist()
```

Out[37]: <Axes: >



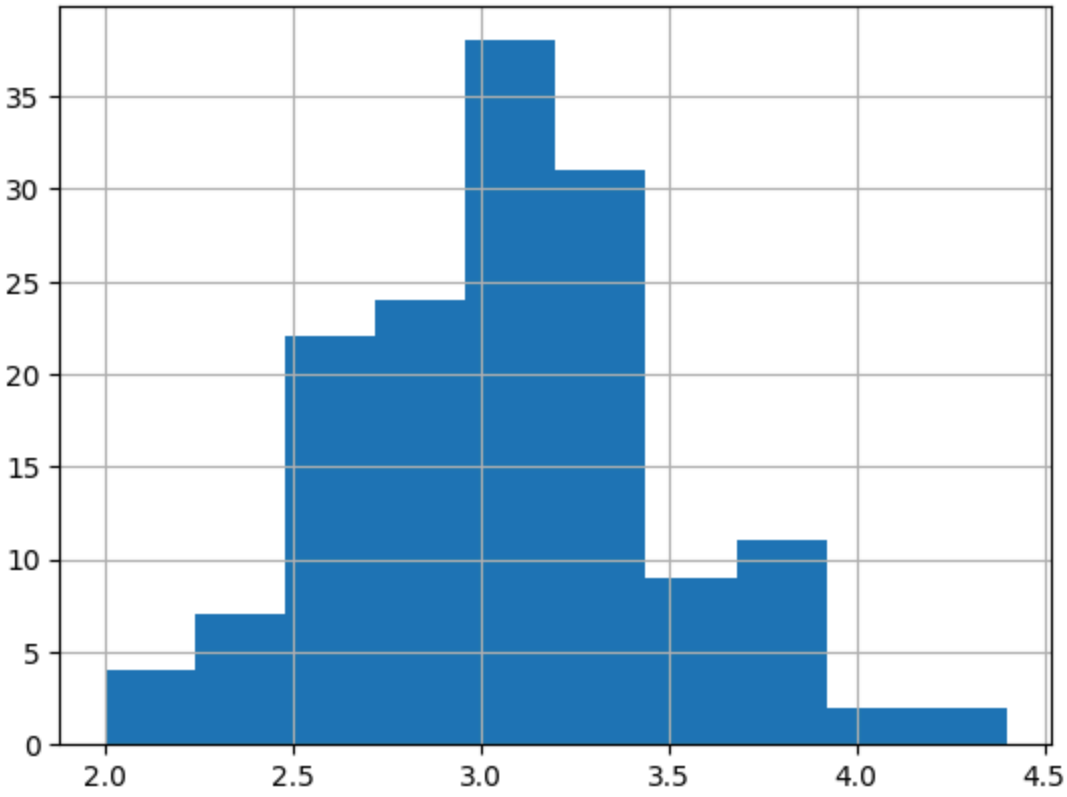
In [38]:
```
df['SepalWidthCm'].hist()
```

Out[38]: <Axes: >



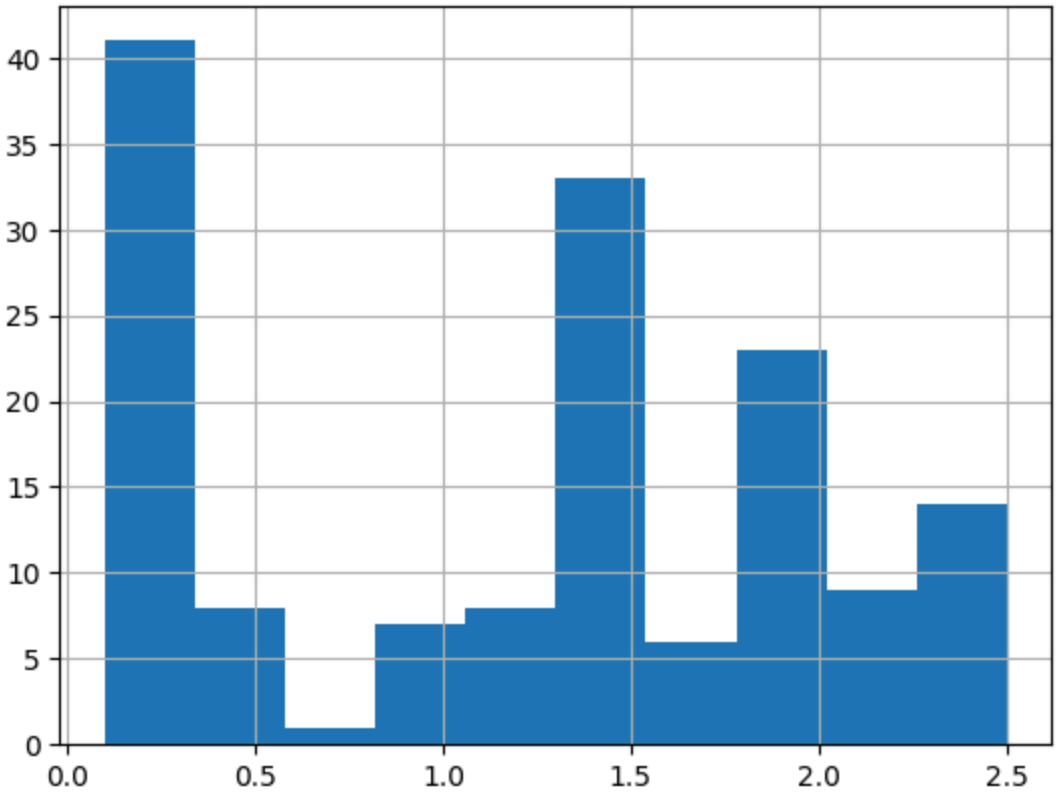
In [39]:
```
df['SepalWidthCm'].hist()
```

Out[39]: <Axes: >



In [40]:
```
df['PetalWidthCm'].hist()
```

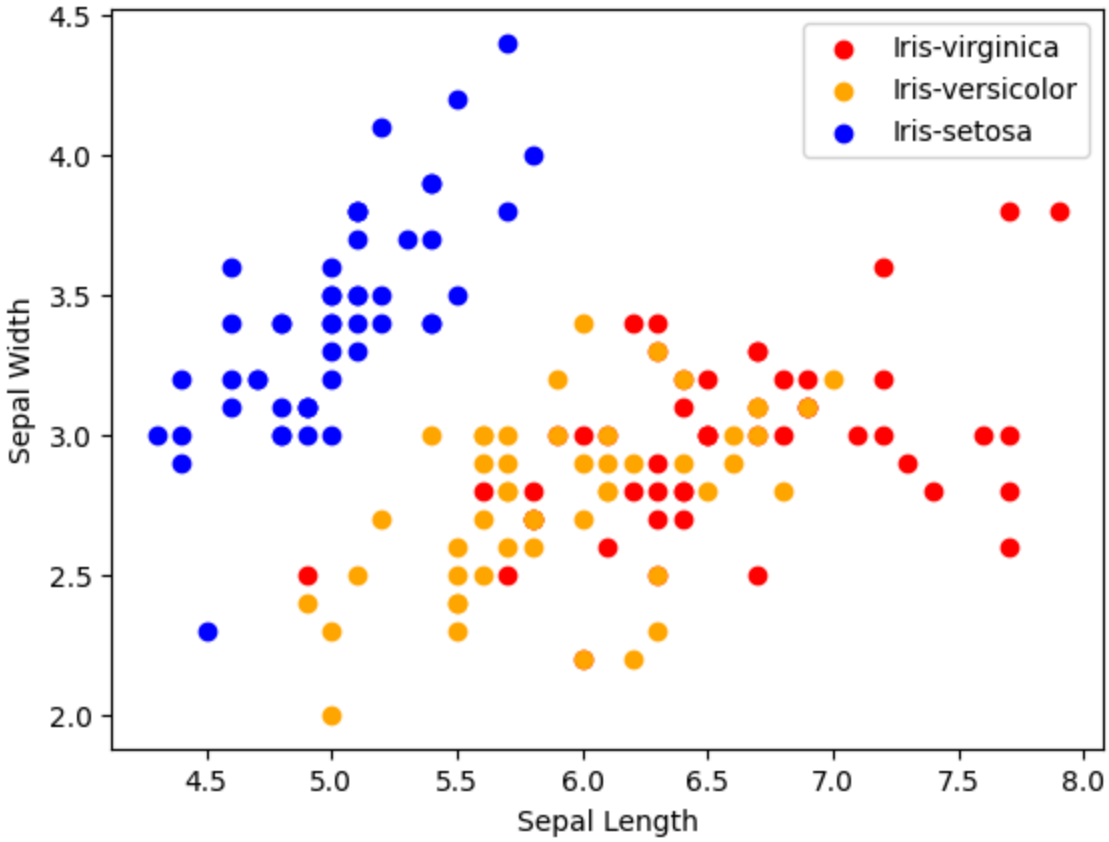
Out[40]: <Axes: >



In [41]:
```
colors = ['red', 'orange', 'blue']
species = ['Iris-virginica','Iris-versicolor','Iris-setosa']
```

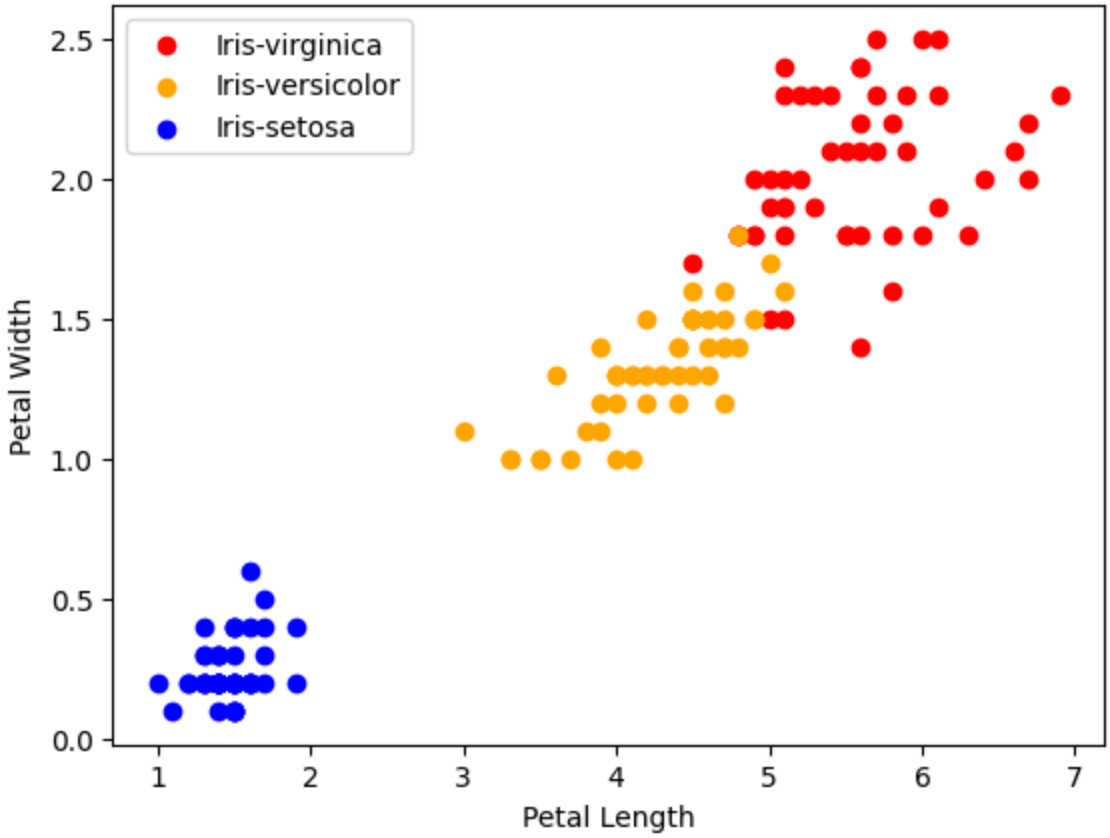
In [42]:
```
for i in range(3):
    x = df[df['Species'] == species[i]]
    plt.scatter(x['SepalLengthCm'], x['SepalWidthCm'], c = colors[i], label=sp
ecies[i])
plt.xlabel("Sepal Length")
plt.ylabel("Sepal Width")
plt.legend()
```

Out[42]:
```
<matplotlib.legend.Legend at 0x27239be7560>
```



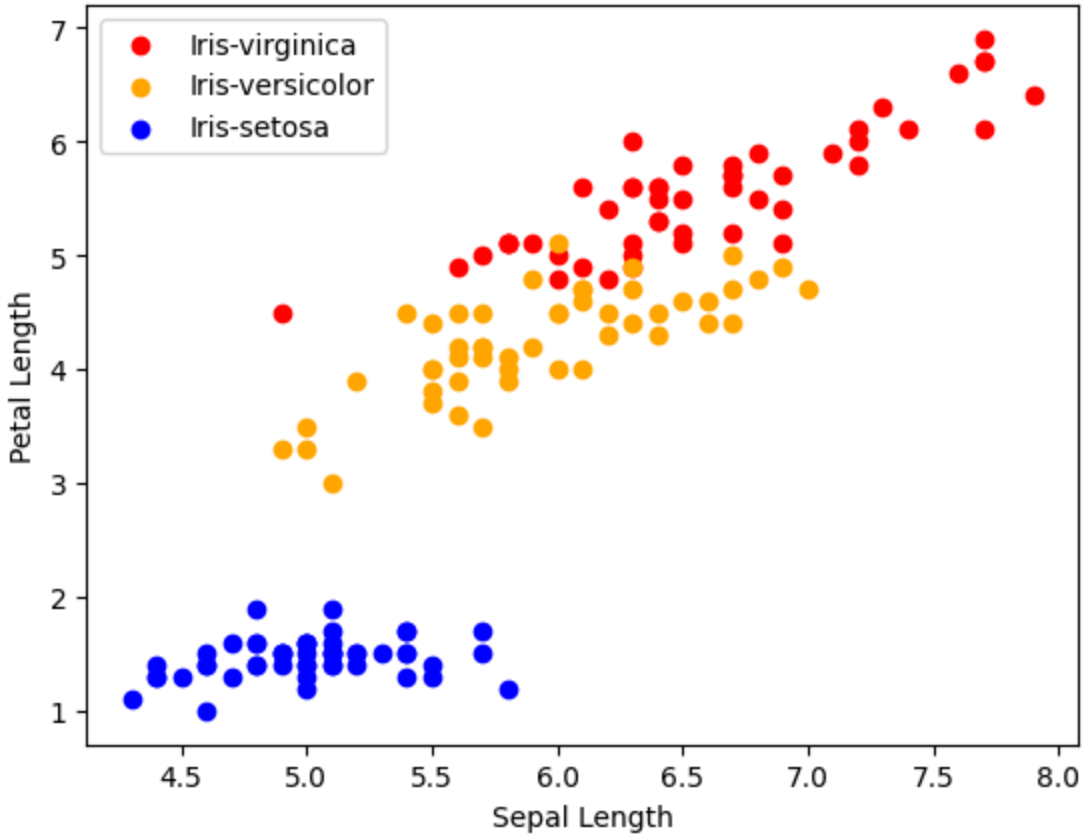
In [43]:
```
for i in range(3):
    x = df[df['Species'] == species[i]]
    plt.scatter(x['PetalLengthCm'], x['PetalWidthCm'], c = colors[i], label=sp
ecies[i])
plt.xlabel("Petal Length")
plt.ylabel("Petal Width")
plt.legend()
```

Out[43]: <matplotlib.legend.Legend at 0x2723a134860>



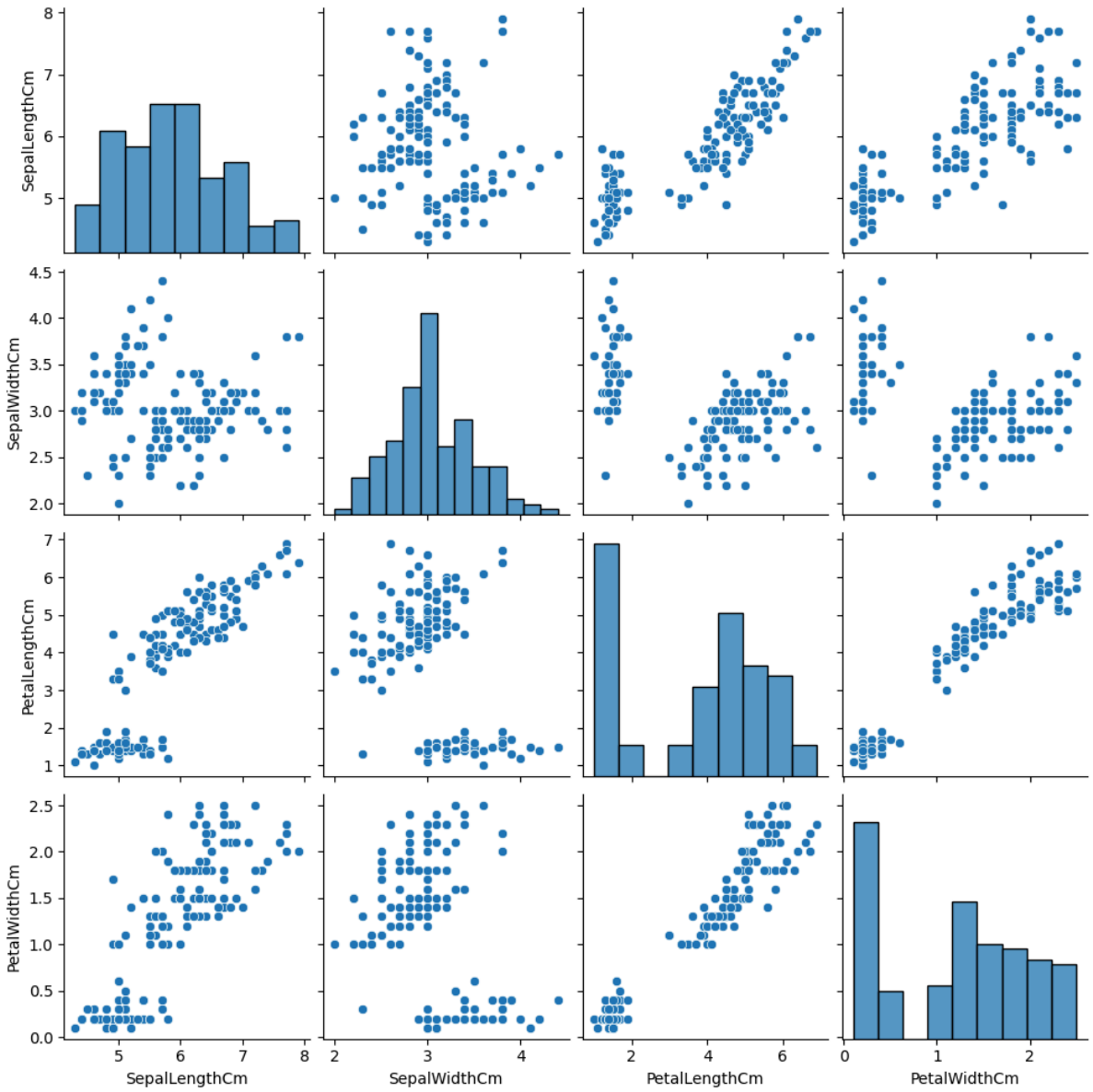
In [44]:
```
for i in range(3):
    x = df[df['Species'] == species[i]]
    plt.scatter(x['SepalLengthCm'], x['PetalLengthCm'], c = colors[i], label=s
pecies[i])
plt.xlabel("Sepal Length")
plt.ylabel("Petal Length")
plt.legend()
```

Out[44]: <matplotlib.legend.Legend at 0x2723a3c4500>



In [23]:
```
sns.pairplot(df)
```

Out[23]:
```
<seaborn.axisgrid.PairGrid at 0x27233b5a930>
```



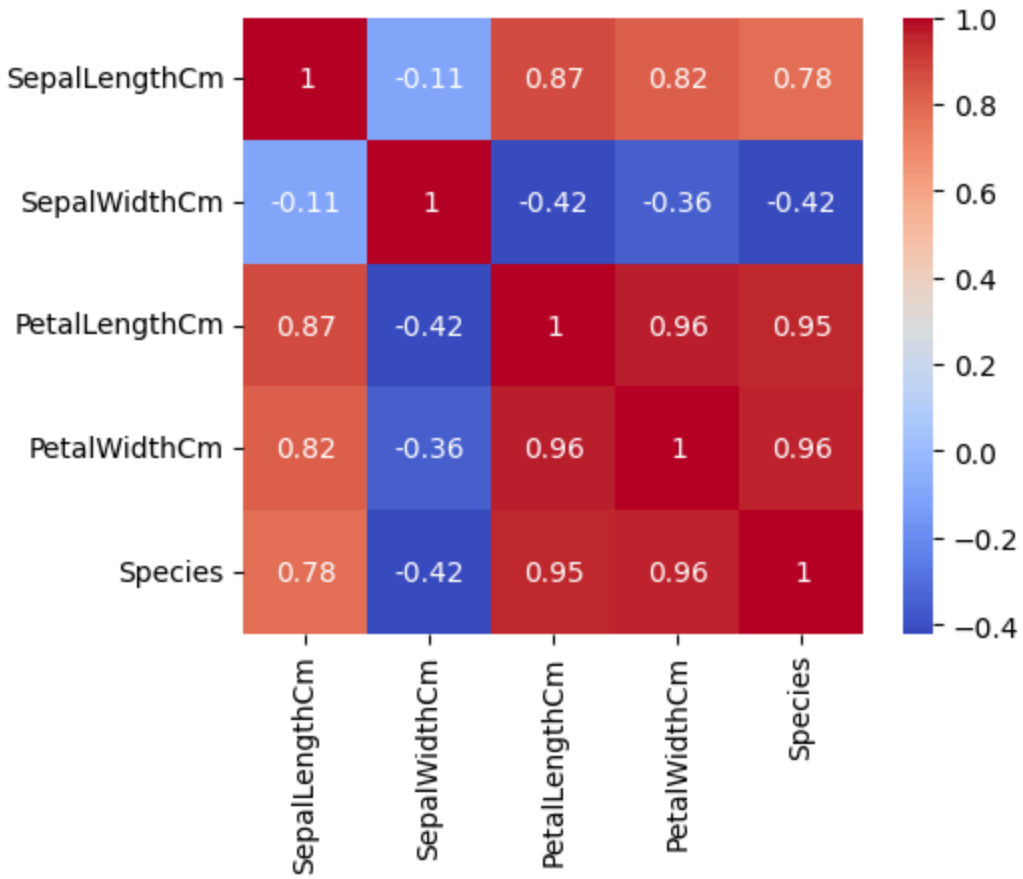
In [47]:
```
df.corr
```

Out[47]:
```
<bound method DataFrame.corr of      SepalLengthCm  SepalWidthCm  PetalLength
Cm  PetalWidthCm         Species
0               5.1           3.5           1.4           0.2     Iris-setosa
1               4.9           3.0           1.4           0.2     Iris-setosa
2               4.7           3.2           1.3           0.2     Iris-setosa
3               4.6           3.1           1.5           0.2     Iris-setosa
4               5.0           3.6           1.4           0.2     Iris-setosa
..              ...           ...           ...           ...             ...
145             6.7           3.0           5.2           2.3  Iris-virginica
146             6.3           2.5           5.0           1.9  Iris-virginica
147             6.5           3.0           5.2           2.0  Iris-virginica
148             6.2           3.4           5.4           2.3  Iris-virginica
149             5.9           3.0           5.1           1.8  Iris-virginica

[150 rows x 5 columns]>
```

In [64]:
```
corr = df.corr()
fig, ax = plt.subplots(figsize=(5,4))
sns.heatmap(corr, annot=True, ax=ax, cmap = 'coolwarm')
```

Out[64]:
```
<Axes: >
```



In [59]:
```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
```

In [60]:
```
df['Species'] = le.fit_transform(df['Species'])
df.head()
```

Out[60]:

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	5.1	3.5	1.4	0.2	0
1	4.9	3.0	1.4	0.2	0
2	4.7	3.2	1.3	0.2	0
3	4.6	3.1	1.5	0.2	0
4	5.0	3.6	1.4	0.2	0

In [61]:
```
from sklearn.model_selection import train_test_split
```

In [62]:
```
X = df.drop(columns=['Species'])
Y = df['Species']
x_train, x_test, y_train, y_test = train_test_split(X, Y, test_size=0.30)
```

In [63]:
```
gaussian = GaussianNB()
gaussian.fit(x_train, y_train)
Y_pred = gaussian.predict(x_test)
accuracy_nb=round(accuracy_score(y_test,Y_pred)* 100, 2)
acc_gaussian = round(gaussian.score(x_train, y_train) * 100, 2)

cm = confusion_matrix(y_test, Y_pred)
accuracy = accuracy_score(y_test,Y_pred)
precision =precision_score(y_test, Y_pred,average='micro')
recall =  recall_score(y_test, Y_pred,average='micro')
f1 = f1_score(y_test,Y_pred,average='micro')
print('Confusion matrix for Naive Bayes\n',cm)
print('accuracy_Naive Bayes: %.3f' %accuracy)
print('precision_Naive Bayes: %.3f' %precision)
print('recall_Naive Bayes: %.3f' %recall)
print('f1-score_Naive Bayes : %.3f' %f1)
```

```
Confusion matrix for Naive Bayes
 [[14  0  0]
 [ 0 16  1]
 [ 0  1 13]]
accuracy_Naive Bayes: 0.956
precision_Naive Bayes: 0.956
recall_Naive Bayes: 0.956
f1-score_Naive Bayes : 0.956
```

In [ ]: