Parasitic Plants and Their Hosts in Pucak Botanic Garden Maros South Sulawesi Province

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Keywords: Diversity, Host, Parasitic pPlant.

Abstract: Parasitic plants live by adhering, absorbing water, minerals and food to host plants. The objective of this research was to determine the diversity of parasitic plants and their hosts in Pucak Botanic Garden ,Maros Regency, South Sulawesi Province. The research was conducted in April 2016 using exploration method in the gardens. The parasitic plants and their hosts were inventoried and observed by purposive sampling method along tracks during exploration. There were three species of the parasitic plants were found in the garden namely *Scurrula ferruginea* (Jack) Dans., *Viscum ovalifolium* Wall. Ex DC, and *Amylotheca dictyopleba* (F.Muell.) Tiegh. The most dominant parasitic plant was *Scurrula ferruginea*, whereas the least dominant was *V. ovalifolium*. There were 4 species, from 4 genera and 4 families of host plants in Pucak Botanic Garden. There should be a space before of 12-point and after of 30-point.

1 INTRODUCTION

Parasitic plants has been often found on cultivated and wild plants in gardens. They live and grow attached to the host plants and absorbing water, nutrients and food from their hosts so they can inhibit growth and reducing yield of the hosts. Solikin (2017) reported that the parasitic plants inhibited growth of cultivated plants in agrofestry lands in Batam such as *Parkia speciosa, Nephelium lappaceum* and *Mangifera indica*. Dominantion of the parasitic plants in natural vegetation have deleterious effects on wild species, such as *Scaevola taccada, Achyranthes splendens* and *Lumnitzera racemosa* on islands in the Chagos Archipelago (Indian Ocean) (Nelson, 2008).

Species domination of parasitic plant and their host were vary depended on location, climate, vegetation and their ecosystem such as *Dendrophtoe pentandra* (L.) Miq. found as the most dominant parasitic plants in Purwodadi Botanic Garden (Solikin, 2016) while *Cassytha filiformis* was the most dominant parasitic plant in agroforestry lands in Pemping and Kepala Jeri Islands Batam (Solikin, 2017). Solikin (2015) found four species of parasitic plants on fruits plants in home gardens in Malang City, namely *Dendrophthoe pentandra* (L.) Miq., *Macrosolen cochinchinensis* (Lour.) Teigh., *Scurrula atropurpurea* (Bl.) Dans. and *S. ferruginea* (Jack.) Dans. Whereas there were five species of parasitic plants obtained on medicinal plants colection in Purwodadi Botanic Garden namely *D. pentandra, M. tetragonus, S. atropurpurea, Viscum articlatum Burm.f.* and *V. ovalifolium* (Solikin, 2014).

Inspite of the parasitic plants are harmfull to the host plants, they have potential as medicinal plants, such as *V. articulatum* being used by the Chinese as a hypertension drug (Bachhav et al, 2012), anticancer (Mutha, Shimpi & Jadhav, 2010), diuretic (Jadhav, Patil & Chaudari, 2010), antioxidant (Kuo et al, 2010), antiulcer (Naganjaneyulu et al, 2011), antiepileptic (Greetha, Gopal & Murugan, 2010), and immunomodulatory (Lu et al, 2011). *Cassytha filiformis* was used againts gonorrhoe, kidney ailment and as diuretic in Taiwan (Mythili, Sathiavelu & Sridharan, 2011), antibacterial action againts Staphylococcus aureus, Escherichia coli and Pseudomonas aeruginosa (Adonu et al, 2013). Some chemical compounds contained in the parasitic plants were alkaloids, flavonoids, saponins, phenolic fraction of methanol-water and steroids (Daniel & Padin, 2012). This research aimed to determine diversity of parasitic plants and their hosts in Pucak Botanic Garden Maros South Sulawesi Province.

Solikin, .
Parasitic Plants and Their Hosts in Pucak Botanic Garden Maros South Sulawesi Province.
DOI: 10.5220/0009915107140719
In *Proceedings of the 1st International Conference on Recent Innovations (ICRI 2018)*, pages 714-719
ISBN: 978-989-758-458-9

2 MATERIALS AND METHODS

The research was conducted in April 2016 in Pucak Botanic Garden, Pucak Village, Tompobulu District, Maros Residence, South Sulawesi Province using explorative and descriptive methods. The garden was situated at altitude of 200 m above sea level, 119o39'12.74" East and 5o8'50.24" South (Fig. 1). Data collection of parasitic plants and their hosts were caried out along tracks during exploration, Each parasitic plant and its hosts which were obtained were recorded and identified.

Taking photographs and making herbarium specimens were conducted to identify plant species founded. Species and number of parasitic plants found on the host plants were recorded. Vegetation analysis to determine Relative Density (RD), Relative Frequency (FR) and Importance Value Index (IVI) of the parasitic and hosts plants were modified from (Indrianto, 2008), Solikin (2016) and Solikin(2017).

Fig.1. Location of Puncak Botanic Garden, Tompobulu, Maros, South Sulawesi.

3 RESULTS AND DISCUSSION

3.1 Species of Parasitic Plants

There were three species of the parasitic plants found in Pucak Botanic Garden namely *Amylotheca dictyopleba* (F.Muell.) Tiegh., *Scurrula ferruginea* (Jack) Dans. from family of Loranthaceae) and *Viscum ovalifolium* Wall. ex DC from the family of Santalaceae (Table 1). The most dominant parasitic plant in Pucak Botanic Garden was *Scurrula ferruginea* with IVI 97.05 (Table 1).

Table 1: Relative density (RD), relative frequency (RF) and important value index (IVI) of parasitic plants in Puncak Botanic Garden.

No.	Species	Family	RD (%)	RF (%)	IVI (%)
1	*Amylotheca dictyopleba* (F.Muell.) Tiegh.	Zoanthacea	55.00	40.91	95.91
2	*Scurrula ferruginea* (Jack) Dans.	Zoanthacea	42.50	54.55	97.05
3	*Viscum ovalifolium* Wall. Ex DC	Santalaceae	2.50	4.55	7.05

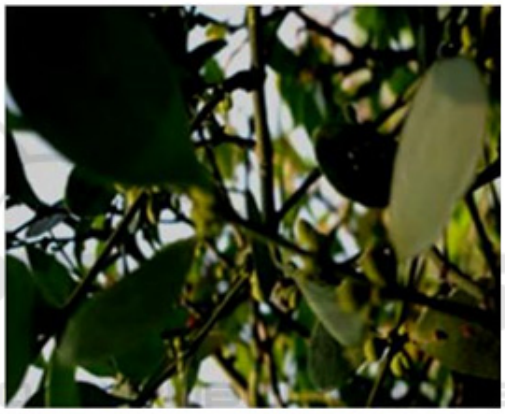

Fig.2. Viscum ovalifolium Wall. Ex DC.

The existence of *V. ovalifolium* (Figure 2) in Pucak Botanic Garden was the least. It was indicated by its value of RF and IVI was the smallest i.e. 4.5 and 7.05, respectivly (Table 1). This may be caused by genetic factor (selected for host and type of seed germination). Solikin (2014) reported that the seed germination of *V. ovalifolium* has epigeal type (cyclament) which cotyledon lifted from the media surface (bark) during germination The seed germination was started by elongation of hypocotyl 0.5-2 cm, green from the bark surface of host plant. There is a round green rounded haustorium (radical) at the tip base of hypocotyl.

After the haustorium has attached and penetrated into the bark, sprout begin to absorb water from the host plant. The cotyledon was lifted and still tightly closed by testes and viscins that dry out as the first leaf grow. This type has high risk for seeds to drop/remove from the surface of medium when rainy and dry before growing and developing to be new plants. Solikin (2015) aslo reported that

population of this parasitic plant in Purwodadi Botanic Garden was rare. On the other hand, *Scurrula ferruginea* (Figure 3) was the most parasitic plant in Pucak with RF and IVI i.e., 54.55 and 97.05 respectively. This may corresponded to genetic factor by producing many seeds and it had hypogeal type seed germination so after the seeds germinated, they were not easy to remove from the bark surface. The seed germination was started by growing of hypocotyl (orobanche) and haustorium which was penetrated into stem tissues and skin of the host plant into phloem and xylem tissues. The hypocotyl did not grow elongated so that the cotyledon / endosperm along with the plumula was not lifted from the bark surface of the host stem.

Scurrula ferruginea was believed to have healing properties such as anticancer, antimicrobial, antioxidant as well as antihypertensive activities (Lim et al, 2016) and treating gastrointestinal ailments (Ameer et al, 2015).

Amylotheca dictyopleba (Figure 4) also dominant parasitic plant in the garden with IVI 95.91. This may be caused by the plants characteristic (seed germination and dispersal) similar to *Scurrula ferruginea*. It was often found as a parasite on some cultivated plants such as *Artocarpus heterophyllus*, *Citrus* spp., *Lagerstroemia speciosa* and *Mangifera indica*. According to information from local people, *Amylotheca dictyopleba* ("malacui") has potential as a medicinal plant. The local people used the flowers to cure hepatitis (a handful of the flowers was boiled into a glass of water till half of glass, then water was drunk). Name of 'malacui' because the flowers were liked by 'cui' bird (a species of of chili birds) which was commonly obtained sucking honey in flowers and
eat fruits of the parasitic plants. It has important role to disperse the seeds of this parasitic plant.

The occurence of parasitic plants on the cultivated plants should be controled because they may danger to the host plants by inhibiting the plant growth and decreasing fruit and seed production. The parasitic plants may also as a host of virus plant disease such as reported by Prota4U (2013) that *Cassytha filiformis* was a host for citrus mosaic virus and citrus yellow corky vein viroid, and has been found to transmit the virus from one Citrus species to another. Solikin (2014) also reported that the invasion of parasitic plants caused death of distal branches of *Cassia fitula* until 75.27 % in Purwodadi Botanic Garden (from 93 branches with the parasitic plant *Dendropthoe pentandra*. The population of parasitic plants will be increase follow the time and increasing number of species and population of host plants such as reported by Solikin (2015) that population of parasitic plant Dendropthoe pentandra and its host in Purwodadi Botanic Garden increased during 2006 – 2013.

Fig.3. The most dominant parasitic plat *Scurrula ferruginea* (Jack) Dans.

Fig 4. *Amylotheca dictyopleba* (F.Muell.) Tiegh.

3.2 Host Plants

There were 4 species divided into 4 genera and 4 families as hosts of parasitic plants found in Pucak Botanic Garden namely *Baccaurea bracteata* Mull. Arg. ,*Citrus nobilis* Lour., *Lagerstroemia speciosa* (L.) Pers. and *Michelia alba* DC (Table 2). The most dominant of host plants was *Citrus nobilis* with IVI 131.67. *Citrus nobilis* was the most dominant host plant of the parasitic plants in Pucak Botanic Garden. It was showed in Table 2 that the RD and RF of this plant was the highest than those on other host plants i.e. 65.00 and 66.67, respectively. It may be caused by this plant have been cultivated in the garden many years ago before the garden had been established in 2004 (Suprapto et

al, 2016). The garden was established as Taman Wisata Pendidikan before this time which

was managed by Dinas Perkebunan, Dinas Perikanan, Dinas pertanian, Dinas Peternakan, Dinas Kehutanan, Dinas Tata Ruang dan Pemukiman, Dinas Kebudayaan dan Pariwisata. The land was one of cultivated plants location as part of agroforestry system so this plant more potential as a host plant of parasitic plant.

Table 2: Relative density (RD), relative frequency (RF) andimportant value index (IVI) of hosts of parasitic plants in Pucak Botanic Garden

No.	Species	Family	RD (%)	RF (%)	IVI (%)
1	*Baccaurea bracteata* Mull. Arg.	Phyllanthaceae	15.00	4.76	19.76
2	*Citrus nobilis* Lour.	Rutaceae	65.00	66.67	131.67
3	*Lagerstroemia speciosa* (L.) Pers.	Lytheraceae	17.50	23.81	41.31
4	*Michelia alba* DC	Annonaceae	2.50	4.76	7.26

C. nobilis is small tree with sporadic branches and leaves so birds like to perch and disperse seeds of parasitic plants on it. The occurence of parasitic plant on family Rutaceae such as on *Citrus* also reported by (Solikin, 2013) in Purwodadi Botanic Garden.

The population of parasitic plants on the other host plants such as Lagertsromea speciosa, Baccaurea bracteata, and Michelia alba were low, because the population of these host plant is low as showed in Table 3 that the RD of these plant wa 15.00, 17.50 and 2.50, respectively.

The recorded plant collection in Pucak Botanic Garden were 17 species of shrubs and 50 species of trees in 2015 (Suprapto et al, 2016). This mean that the plants was still relatively young for trees collection (about 5-15 years). These plants have potential as hosts plant of parasitic plants because the population growth and development of the parasitic plants were dynamic depended on time, species and population of the host plants.

Table 3: Distribution of parasitic plants on the stem of host plant

Position of branch	RD (%)	RF (%)	IVI (%)
I	9.30	7.69	16.99
II	32.56	34.62	67.18
III	5.58	26.92	52.50
IV	32.56	30.77	63.33
Main stem	0	0	0

Note: RD=Relative density; RF= relative frequency and IVI= Important value index (IVI)

3.3 Parasitic Plant Distribution on Branches of Host Plants

The parasitic plants commonly were found sticking on the branches of the host plants where light can be intercept into leaf canopy fully. Table 3 showed that the parasitic plants were mostly founded on the-II – IV branches which light can reach the leaf canopy. There was no parasitic plants found on the main stem or the main stem . The occurence of parasitic plants on the host plants commonly was caused by birds which eated the seeds of the parasites. The birds obtain nutritional value from fruits of parasitic plants while the parasites get benefit by having their seeds dispersed. The mesocarp of the fruits of parasitic plants contain nutrients which attractive to the birds. They pearched and faeced on the branches. The seed was covered by a sticky viscin that allows the seed to adhere to host branches. They are not digested in digestive system and removed together with faeces. The seeds which dropped and sticked on the branches will germinate and become new plants.

Positions where the parasitic plants sticked to the host plants branches were branches II – IV while on the main stem or main stem was not found the parasites. This is likely caused by position of the main stem is upright so it is impossible for birds perch and also magnitude of water flow on the stem will release of the seeds attached. The positions may be depended on the plant habites, age, birds dispersal and branching type. Solikin (2014) reported that the parasitic plants can be found on branch VII. All the parasitic plants founded in Pucak Botanic Garden was hemiparasite so light is an important factor for their growing so they commonly obtained on upper branches where the light can be captured fully by leaf canopy layer.

The occurence of the parasites on the branches caused tissues damage and death of the parasitized branches because of the disruption in the translocation of water, nutrients and photosynthate to the particular branches. The distal branches death of Cassia fistula be caused by presence of the parasites reach 75.27 % of the 93 branches were observed (Solikin, 2014).

The branches position where the parasites most commonly found was on branch II with RD, RF and IVI , i.e. 32.56, 34.62 and 67.18 respectively

(Table III). It showed that this branch position is the most suitable place to growing the parasites. It is also reported by Solikin (2013) that in this branch position found most parasitic plants on the family Rutaceae growing in Purwodadi Botanic Garden. Domination the parasitic plants on this branch may be caused by the habites of Citrus nobilis (small tree) so branch of II or IV where the light can be captured more.

4 CONCLUSIONS

Scurrula feruginea (Jack) Dans. was the most dominant parasitic plnats in Pucak Botanic Garden with IVI 97.05. Citrus nobilis Lour. was the most dominant host plants of parasitic plant with IVI 131.67.

ACKNOWLEDGEMENTS

We thanks to The Director of Centre for Plant Conservation of Botanic Gardens, Indonesian Institute of Science who gave funding and chance to conduct floral exploration in Maros Residence, South Sulawesi Province and Director of Pucak Botanic Garden and the staffs who helped during the floral exploration

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