Distribution, Composition and Economic Importance of Diseases and Insect Pests of Castor and Mulberry Plants in Some Parts of Ethiopia

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Abstract

Survey was carried out to study the distribution, composition and economic importance of diseases and insect pests of castor and mulberry plants between 2009 and 2011 in some parts of Ethiopia. From the surveyed areas, insect pests and diseased plants were observed and distinguished at their station. In addition, sample pests and infected plant parts were taken and examined in Melkassa Agricultural Research Center. The result showed that Mealy bugs (*Paracoccus sp.*), Scale insects *(Aonidiella sp.* and *Coccus sp.),* Semi looper (*Achoea sp.),* Common bugs (*Acrosternum sp.),* Jassids (*Empoasca sp.* and *Eurymela sp.*), Hairy caterpillar *(Euproctis sp.*), Stinkbug (*Nezara sp.),* and grass hoppers (*Ornithacris sp.)* were observed as insect pests on castor with different rate of infestation and damage level. Very high infestation and damage level were found from mealy bugs, scale insects and common bugs. The most widely distributed insect pests were common bugs, jassids and Semi looper which were recorded from most of the surveyed areas. Mulberry borer (*Apriona sp.*), common jassid (*Eurymela sp.*), soft scale insects (*Pulvinaria sp.)* were recorded as insect pests on mulberry plant. Among castor diseases *Alternaria sp., Fusarium sp., Melampsora sp., Cercospora sp.* and *Xanthomonas sp.* were recorded. Incidence and severity were high when castor plant was infected with *Alternaria sp., Cercospora sp.* and *Melampsora sp.* All causal organisms of castor diseases were distributed in the surveyed areas. Among diseases *Cercospora sp., Phyllactinia sp.* (powdery mildew), and *Pseudomonas sp.* was found to infect mulberry cultivars. The major and widely distributed disease in mulberry was *Cercospora sp.*

Key words: Castor, mulberry, insect pests, diseases, distribution, composition

Introduction

Feed plants (mulberry and castor) and silkworm constitute the basic components of sericulture industry. The quality of leaf plays a major role in improving the commercial characters of the cocoon. The term quality leaf signifies the presence of essential constitutes required for proper silkworm nourishment. For ideal silkworm rearing, the leaf should contain 70-80 % leaf moisture, more than 25 % protein and 11-15 % carbohydrate content. However, due to the attack of pests, the necessary constituents of leaf decline to a considerable extent affecting silkworm rearing (Madhava *et al.,* 1982). Therefore, to obtain large quantity of good quality of castor and mulberry leaves, not only high yielding varieties are to be evolved and grown under optimum agronomical conditions, they are required to be protected from diseases and pests (Basavaraja *et al.* 2005).

Feeding of infected leaves has been found to adversely affect the growth and development of the silkworm, cocoon yield and silk quality (Sullia and Padma, 1987). For example, mulberry is attacked by about 300 species of insect pests. Among them, pink mealy bug, *Maconellicoccus hirsutus* Green is the most serious causing more than 35 per cent yield loss besides impairing nutritional quality of mulberry

leaves (Madhuri *et al*, 2014). In addition, castor is known to be attacked by about 150 pathogens which include mostly fungi, bacteria, and nematodes. However, only few pathogens and insect pests can cause economic importance, at different crop growth stage, depending upon the seasonal conditions (Raoof and Nageshwar, 1999). Castor and mulberry can be affected by diseases and insect pests in the country. Among them some diseases and insect pests can be economically important which affect the growth of castor and mulberry and cause damage to the plant and loss in leaf yield in Ethiopia. It is thus very imperative to identify and protect the plants from different diseases and insect pests to derive maximum benefit from silkworm rearing. So to design effective controlling strategy for these biotic stresses, identification and distribution of major diseases and insect pests of mulberry and castor (silkworm feed plants) is found essential. Therefore, the objective of this study was to assess distribution, composition and economic importance of diseases and insect pests of castor and mulberry cultivars.

Materials and Methods

The survey was carried out in the Central Rift Valley of Ethiopia, South Western Ethiopia, in the vicinity of Addis Ababa, and in Southern Nations, Nationalities and People /SNNP/ Region from 2009 to 2011 at vegetative and maturity growth stages of castor and mulberry plants. In these locations, the plants were mainly grown on the border of the farmers' main lands, around animal grazing areas, fences and degraded lands. In addition, they were also cultivated for utilization as feed plant source for silkworms in some areas. Thus, site selections for the surveyed areas were carried out in collaboration with experts from the respective districts bureaus of agriculture. A total of 61 districts were surveyed. From each district/woreda 10 to 15 kebeles were selected and from each kebele 10 to 20 sampling fields were evaluated depending on the size and production status of castor and mulberry plants. Per sampled field 10 to 15 random sample units (plants) were taken to assess pest prevalence from each of the upper, middle and lower canopy layers of the main stem.

Moreover, sample infested/infected plant parts and insect pests were collected from the same selected sampling fields and brought to Melkassa Research Center Plant Protection Laboratory for the further identification of diseases and insect pests. For the identification purpose of diseases in laboratory two types of growth media were used. The insect damage scale was assigned according to Seif and Hillocks (1999) that states very low (≤5%), low (6-10%), medium (11-20%), high (21-50%) and very high (> 50%) levels.

To grow fungal pathogens potato dextrose agar and for bacterial growth nutrient agar were applied. On the other hand, direct microscopic observation of the infected plant parts was used for the identification of obligate parasites. Data such as number of infested or infected plants versus total number of plants, damaged plant parts (Size and number of lesion/necrosis) versus total area of plant tissue were recorded to determine percent incidence (infestation) and severity (damage level). Incidence and severity of pests from the attacked plants, was calculated by using the following formula.

$$Incidence\,(I) = \frac{Number\ of\ affected\ plant units}{Total\ number\ of\ plant units (healthy\ and\ affected\ units\ assessed)} x100$$

$$Severity\,(S) = \frac{Area\ of\ plant tissues\ affected\ by\ pest}{Total\ area\ of\ plant\ (tissue)} x100$$

Results and Discussion

The present survey revealed distribution, composition and economic importance of insect pests and diseases of mulberry and castor plants in some parts of Ethiopia. Insect pests and diseases of silkworm feed plants are found to be important to reduce biomass yield and quality in our study, which is in agreement with Raina and Himantharaj (2004) findings.

Infestation rate of mealy bugs and scale insects (in Fentale) and lepidopterous shoot borer (in Arbaminch) were very high. Forty percent of castor leaves were covered by mealy bugs and scale insects and the damage level was about 35% in Fentale area (Table 1). High infestation rate (32%) and damage level (45%) were recorded due to lepdopterous shoot borer attack on castor stems and branches around Arbaminch during 2009. This borer was not appeared after wards. Hence, it could be thought as sporadic pest which require close follow up in castor growing areas of Ethiopia in the future. Similar studies conducted by Madhuri *et al* (2014) explained that pink mealy bug, *Maconellicoccus hirsutus* Green is the most serious pest causing more than 35 per cent yield loss besides impairing nutritional quality of leaves on host plant of silkworms.

Among the insect pests recorded, Common bugs, Jassid and Semi-looper were widely distributed in most of the surveyed areas though the damage level of these insects were low with the exception of Adama district in which the abundance of common bug was relatively high. In this locality the damage level of this insect was estimated at 22% on castor leaves (Table 1). Similarly; Grasshopper and Stinkbug (only in Arbaminich Zuria) and hairy caterpillar (only in Wondogenet) were also recorded on some leaves of castor plant with very low population density. Damage level for the above insect pests were less than 2% (Table 1). According to Jayaraj (1967), among the different sucking pests on castor in India, the Jassid is the most important one due to characteristic symptoms of hopper burn appear owing to the toxogenic nature of the insect saliva which was in agreement with our findings. Hopper burn and stunting damage caused by heavy population of jassid resulted to losses of vitality and poor formation of capsules (Rai, 1976). In similar studies, Sarmah and Chakravorty (2005) also stated castor hairy caterpillar (*Euproctis lunata* Wlk.), Semilooper (*Achoea janata* L.), Jassids (*Empoasca flavescens* Fb.) and Capsule borer (*Dichrocrocis punctiferalis* Guen) were the major pests of castor in India. These pests, which are found to be minor in our study, may become serious pest in Ethiopia also in future as that of India.

In regard to insect pests in mulberry cultivars, the survey result indicated that more than 50% infestation rate on mulberry stems was estimated due to mulberry borer (*Apriona sp)* in Alage in 2009. During the next two consecutive years this insect was not observed. Hence, it could be considered as sporadic pest and may appear any time if favorable conditions permit for its occurrence in Alage or other areas. Other minor insect pests recorded in the mulberry cultivars are jassid (*Eurymela sp.*) and soft scale insects (*Pulvinaria sp.*) in Alage and jassid (*Empoasca sp.)* in Arbaminch which their damage were below 0.1% (Table 2). On the other hand, there was no insect pest recorded on mulberry plants in other surveyed locations. In related studies by Sunil and Chandrashekar (2013) in India, about 300 insect and non-insect species of pests are known to occur on mulberry. The same author discussed that the major insect orders known to be the insect pest of mulberry are Lepidoptera, Hemiptera, Coleoptera, Thysanoptera, Orthoptera and Isoptera but only Lepidopteran and Hemipteran insect pests were found as insect pests of mulberry in our case. According to Manjunath *et al.* (2003), the average incidence and loss in mulberry leaf yield caused by Pink mealy bug *Maconellicoccus hirsutus* pests was estimated to be 34.24 % and 4500 kg/ha/year, respectively. Similarly, Saratchandra (1997) stated that the tachinid fly (*Exorista bombycis*), popularly known as uzi fly, was the most serious pest and recorded 10 to 40 % silkworm crop loss due to uzi infestation.

The cultivated mulberry species are believed that they were introduced and planted long years back in Ethiopia (Metaferia *et al.*, 2006). Those cultivated species of mulberry plants may have coevolved with various insect pests for many years and/or some of them could have resisted and continue to grow until today. The situation of low injury or damage to mulberry and castor plants could also be attributed by the presence of natural enemies. Different natural enemies of insect pests on mulberry and castor plants were also observed during the study period which includes different species of lady bird beetles (*Cheilomenes sp.)*, ants, dragon flies and spiders.

Table 1. Distribution, composition and damage extent of insect pests of castor in some parts of Ethiopia between 2009 and 2011

Zone /Sub-cities	District / Woreda	Insect Pests				Infestation (%)	Damage level (%)
		Common name	Order	Family	Scientific name		
	Fentale	Mealy bugs	*Hemiptera*	*Geometroidea* ****	*Paracoccus sp.****	40	35
		Scale insects	*Hemiptera*	*Diaspididae****, *Coccidae*	*Aonidiella sp.****, *Coccus sp.*	40	35
		Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	0.01	0.01
		Semi looper	*Lepidoptera*	Noctuidae	*Achoea sp.**	0.01	0.01
	Boset	Mealy bugs	*Hemiptera*	*Geometroidea* *	*Paracoccus sp.* *	0.05	0.05
	Adama	Common bugs	*Hemiptera*	*Pentatomidae*	*Acrosternum sp.****	20	22
East Shoa		Mealy bugs	*Hemiptera*	*Geometroidea*	*Paracoccus sp.* ***	22	17
		Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	3	2
		Semi looper	*Lepidoptera*	*Noctuidae*	*Achoea sp.**	5	1
	Lume	common bugs	*Hemiptera*	*Pentatomidae*	*Acrosternum sp.**	1	2
		Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	10	2.5
	Dugda	Common bugs	*Hemiptera*	*Pentatomidae*	*Acrosternum sp.**	1	2
	Alem Tena	Common bugs	*Hemiptera*	*Pentatomidae*	*Acrosternum sp.**	3	2
	Adae	Semi looper	*Lepidoptera*	*Noctuidae*	*Achoea sp.**	5	1
	Adamitulu	Common bugs	*Hemiptera*	*Pentatomidae*	*Acrosternum sp.**	3	2
	Arsi-Negele	Common bugs	*Hemiptera*	*Pentatomidae*	*Acrosternum sp.**	2	2
West arisi	Shashamene	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	0.02	0.02
	Sebeta	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	5	1
Finfine Zuria	Dukem	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	5	1
Gamogofa	Arbaminch Zuria	Shoot borer	*Lepidoptera*	*Pyraustidae****	*Conogethes sp.* ****	32	45
		Stinkbug	*Hemiptera*	*Pentatomidae**	*Nezara sp.**	2	1
		Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	13	2
		Grasshoppers	*Orthoptera*	*Acrididae*	*Ornithacris sp.**	13	2
West Shewa	Woliso	Semi looper	*Lepidoptera*	*Noctuidae*	*Achoea sp.**	5	2
		Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	5	2
	Becho	Semi looper	*Lepidoptera*	*Noctuidae*	*Achoea sp.**	5	5
		Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	5	1
Jimma zuria	Sokoru	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	5	1

	Mena	Common bugs	*Hemiptera*	*Pentatomidae*	*Acrosternum sp.**	6.5	2
		Semi looper	*Lepidoptera*	*Noctuidae*	*Achoea sp.**	6.5	2
		Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	6.5	2
	Kersa	Common bugs	*Hemiptera*	*Pentatomidae*	*Acrosternum sp.**	5	1
Gurage	Kebena	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	5	1
Wolaita	Sodo zuria	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	10	1.5
	Boloso Sore	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	10	2
		Semi looper	*Lepidoptera*	*Noctuidae*	*Achoea sp.**	10	2
Hadiya	Limu	Common bugs	*Hemiptera*	*Pentatomidae*	*Acrosternum sp.**	10	2.5
	Badawacho	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	4	1
Sidama	Wondogenet	Hairy caterpillar	*Lepidoptera*	*Lymantriidae*	*Euproctis sp.**	0.02	0.02
		Common bugs	*Hemiptera*	*Pentatomidae*	*Acrosternum sp.**	10	1
	Hawassa Zuria	Common bugs	*Hemiptera*	*Pentatomidae*	*Acrosternum sp.**	15	2
Nefas silk - Lafto	Woreda 1	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	5	1
Akaki- Kaliti	Woreda 6	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	5	1
	Woreda 2	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	5	1

Key→ * = very low, **= low, ***= medium, ****= high, *****= very high,

Table 2. Distribution, composition and damage extent of insect pests of mulberry in some parts of Ethiopia between 2009 and 2011

Zone /Sub-cities	District / Woreda	Insect Pests				Infestation (%)	Damage level (%)
		Common name	Order	Family	Scientific name		
Between East Shewa and Silte Zone	Alagae	Mulberry borer	*Coleoptera*	*Cerambycidae*	*Apriona sp.****	50	40
		common jassid	*Hemiptera*	*Cicadellidae*	*Eurymela sp.**	3	0.05
		soft scale insects	*Hemiptera*	*Coccidae*	*Pulvinaria sp.**	1	0.02
Gamogofa	Arbaminch	Jassid	*Hemiptera*	*Cicadellidae*	*Empoasca sp.**	5	0.01

Key→ * = very low, **= low, ***= medium, ****= high, *****= very high

Note: There was no any insect pest infestation and damage on mulberry plants on other surveyed locations

Fungal pathogens such as *Alternaria sp. in 26, Cercospora sp.* in 21, *Fusarium sp. in* 19, and *Melampsora sp.* (rust) in 18; bacterial pathogen *Xanthomonas sp.* in 21 districts were recorded as castor diseases among the surveyed areas with different level of infection (Table 2). Among the observed pathogens, the disease infection rate by *Alternaria sp., Cercospora sp.* and *Melampsora sp.* was relatively high in castor. Disease infection rate by *Alternaria sp.* was high in Fentale, Boset, Adama, Arsinegelle, Shashemene and Arbaminch districts. Disease incidence and severity by *Alternaria sp.* from leaves and capsules in Fentale (15% and 21%), in Boset (30% and 35%), in Adama (15% and 22%), in Arsinegelle (20% and 21%), in Shashemene (15% and 21%) and in Arbaminch (27% and 42%) were recorded respectively. In general disease incidence by *Alternaria* was estimated between 15% and 30% while severity was between 21% and 42%. *Alternaria blight* is a common and wide spread disease of castor in wet years in India according to Rangaswamy *et al* (1970) which is in agreement with the current findings of our study. As indicated by the same authors in India, about 70% of the plants in some fields are reported to be affected resulting in serious loss in yield and oil content by *Alternaria blight.*

The prevalence of *Cercospora sp.* was dominant in Wondogenet, Hawassa zuria, Arbaminch zuria, and in Mana (Jimma zuria). The disease incidence and severity on castor leaves of *Cercospora sp.* were 38% and 37% (in Wondogenet area), 40% and 35% (in Hawassa zuria), 30% and 35% (in Arbaminch zuria) and 40% and 39% (in Mana district of Jimma zuria) . It can be stated that disease incidence by *Cercospora sp.* was estimated between 30% and 40% while severity was between 35% and 39%. Cercospora leaf spot is a common disease in most countries of the world. In India, the incidence and severity of the disease is variable. Losses due to the disease are considerable, where the leaves are fed to the eri-silkworms (Maiti *et al*, 1989). Pathogenecity due to *Melampsora sp.* (rust) on leaves was found high in Adama, Lume and Shashamene. Disease incidence by *Melampsora sp.* was 40% and severity was 35% in Adama, this was 15 and 23% in Lume and 35% and 41% in Shashamene. Rust (*Melampsora ricini*) is recorded as important diseases on castor (Rangaswamy, 1979) and it is a serious disease of castor inflicting considerable qualitative as well as quantitative losses. Previously *Melampsora ricini* was the only fungal disease of castor mentioned in Ethiopia in the literature (Candussio & Scabardi, 1953).

Fusarium disease in roots, stems, branches and leaves of castor plant were occurred in East Shewa, West Shewa, Finfine zuria, Gamugofa, Jimma zuria, Guraghe and Sidama zones with low extent of damage that ranged between 0.01% and 3%. Fusarium wilt is the most important soil and seed borne disease of castor and was recorded in India for the first time from Udaipur (Rajasthan) by Nanda and Prasad (1974). The authors mentioned that the disease incidence was observed to the extent of 20% on Gujarat hybrid. The extent of yield loss depends on the stage at which the plants wilt, 77% at flowering stage, 63% at 90 days and 39% at later stages on secondary branches (Pushpavati, 1995).

Similarly low bacterial disease (*Xanthomonas sp*) infection of castor that ranged between 0.02% and 5% was registered in East Shewa, West Arisi, West shewa, Jimma zuria, Gurage, Sidama and Akaki-kaliti zones (Table 3). In general *Alternaria, Cercospora sp.* and *Xanthomonas sp* were widely distributed followed by *Fusarium* and *Melampsora sp.* (rust). In india up to mid seventies, rust, powdery mildew, leaf spots and blights were recorded as important diseases on castor (Rangaswamy, 1979) which support our findings.

Among diseases *Cercospora sp., Phyllactinia sp.* (powdery mildew), and *Pseudomonas sp.* was found to infect mulberry cultivars. The major and widely distributed disease in mulberry was *Cercospora sp.* Disease prevalence by *Cercospora sp.* on mulberry was high in East Shewa (Adama), Jimma zuria (Mena), Gamogofa (Arbaminch Zuria), Sidama (Awassa zuria and Wondogenet). Disease incidence that ranged between 30% and 40%, and severity 35% and 43% were recorded from *Cercospora sp.* infection on mulberry in these areas. Among the various foliar diseases, leaf spot *(Cercospora moricola)* constitutes the greater epideological

constrain, affecting almost all the popular mulberry varieties cultivated farmers level in south India. Yield loss due to leaf spot varies in different varieties ranging between 1.67 and 13.41 % Govindaiah *et al.,* 1989. Sukumar and Ramalingam (1989) also stated that leaf spot disease caused by *C. moricola* causes direct leaf yield loss of about 5 % due to defoliation and an additional loss of 20-25 % by the destruction of leaf area. In local and K-2 varieties, direct yield loss is as high as 10-12 % (Sikdar and Krishnaswami, 1980). Disease pressure from *Phyllactinia sp.* (0.2 to 2%) and *Pseudomonas sp.* (0.3%) was very low in mulberry cultivar (Table 4).

Table 3. Distribution, Species composition and prevalence of diseases of castor in some parts of Ethiopia between 2009 to 2011

Zone/Sub-cities	District/woreda	Pathogen	Incidence (%)	Severity (%)
	Fentale	*Alternaria sp.***	15	21
	Boset	*Alternaria sp.****	30	35
		*Fusarium sp.**	0.5	1
		*Xanthomonas sp.**	0.02	0.5
	Adama	*Melampsora sp* ****	40	35
		Alternaria spp. ****	15	22
East Shewa		*Fusarium Spp.* *	1	0.5
		Xanthomonas sp. *	3	2.5
	Lume	*Melampsora sp* ****	15	23
	Dugda	*Fusarium sp.**	1	1
	Alem Tena	*Xanthomonas sp.**	2	1
	Adamitulu	*Alternaria sp.***	5	10
	Arsi-Negele	*Alternaria sp.* ****	20	21
	Adea	*Xanthomonas sp.**	0.5	0.02
West Arisi	Shashamene	*Melampsora sp.* ****	35	41
		Alternaria sp. ****	15	21
		Xanthomonas sp. *	0.05	0.02
	Dukem	*Alternaria sp.,**	5	3
Finfine Zuria	Sebeta	*Fusarium sp* *	1.5	2
		*Alternaria sp.,**	5	2
Gamogofa	Arbaminch zuria	*Alternaria spp.* ****	27	42
		Fusarium Spp. *	2	1.5
		Cercospora sp ****	30	35
	Woliso	*Melampsora sp* *	5	3
		Fusarium sp *	1	1.5
West Shewa		*Xanthomonas sp.**	7	5
	Becho	*Melampsora sp.* *	7	5
		*Cerospora sp.,***	10	15
Jimma zuria	Sokoru	*Cerospora sp.,***	10	15
	Mena	*Alternaria sp.,**	6	5
		Melampsora sp. **	10	7.5
		Fusarium sp *	5	3
		*Cerospora sp.,****	40	39
		*Xanthomonas sp.**	3	2.5
Guraghe	Kebena	*Fusarium sp* *	0.5	0.2
	Wolkite	*Cerospora sp.,* *	10	5
	Abeshige	*Cerospora sp.,* **	5	7
		*Xanthomonas sp.**	0.03	0.5
	Yem	*Fusarium sp* *	0.02	0.01
Wolaita	Sodo zuria	*Alternaria sp.,* *	3	2
	Boloso Sore	*Cercospora sp* *	10	5
	Boditi	*Alternaria sp.**	0.2	0.5
Hadiya	Limu	*Alternaria sp.**	0.5	1
	Badawacho	*Cercospora sp* ***	10	15

Sidama	Wondogenet	*Cercospora sp.* ****	38	37
		Fusarium sp. *	3	1
		Alternaria sp, *	3	2
		Melampsora sp. *	0.5	2
		*Xanthomonas sp.**	0.5	1.5
	Hawassa zuria	*Cercospora sp* ****	40	35
		*Melampsora sp.**	2	5
		*Xanthomonas sp.**	1	2
Nefas silk-Lafto	Woreda 1	*Alternaria sp,**	2	1
Akaki Kaliti	Woreda 6	*Alternaria sp,**	0.02	0.5
	Woreda 2	*Cercospora sp* *	0.02	0.5
		*Xanthomonas sp.**	0.02	0.5

Table 4. Distribution, Species composition and prevalence of diseases of mulberry in some parts of Ethiopia between 2009 to 2011

Zone/Sub-cities	District	Pathogen	Incidence (%)	Severity (%)
East Shewa	Adamitulu- Jido-Kombolcha	*Cerospora sp.***	10	15
	Dugda	Cerospora sp.***	12	17
	Adama	*Cerospora sp.****	35	40
		Phyllactinia sp. *	3	2
West Shewa	Woliso	*Cercospora sp.****	10	12
		*Pseudomonas sp**	0.02	0.3
Jimma zuria	Mena	*Cerospora sp.*****	35	40
	Kersa	*Cerospora sp.****	10	11
Gurage	Wolkite	*Phyllactinia sp.**	0.02	0.2
Gamogofa	Arbaminch Zuria	*Cerospora sp.*****	30	35
		Phyllactinia sp. *	2.5	1
Sidama	Hawassa zuria	*Cerospora sp.* ****	40	38
		*Phyllactinia sp.**	1	0.5
	Wondogenet	*Cerospora sp.*****	35	43
Akaki Kaliti	Woreda 2	*Phyllactinia sp.* *	1	1.5

Key→ * = very low, **= low, ***= medium, ****= high, *****= very high,

Conclusion and Recommendation

The present study provided some clues to the understanding of the distribution, composition and economic importance of diseases and insect pests of silkworm feed plants in Ethiopia. From this study it can be concluded that the major insect pests for castor plant were mealy bugs, scale insects and common bugs. The most widely distributed insect pests in castor were Common bags, Jassids and Semi-looper which were recorded from most of the surveyed areas. Jassids, Semi-looper, Hairy caterpillar, Stink bug, and Grasshoppers could be considered as minor pests for castor. Jassids and soft scale insects were found as minor pests for mulberry. The devastating effect of lepdopterous shoot borer on castor around Arbaminch and mulberry borer on mulberry in Alage during 2009 as sporadic pests requires a close follow up in silkworm feed plants growing areas of Ethiopia to take appropriate control measure.

The major and widely distributed diseases of castor were *Alternaria sp., Cercospora sp.* and *Melampsora sp.* which needs control measure while *Fusarium sp.* and *Xanthomonas sp* can be treated as minor diseases of castor that may not

need control interventions. The major and widely distributed disease for mulberry plant was *Cercospora sp.* while *Phyllactinia sp.* and *Pseudomonas sp.* can be taken as minor pests. Understanding the situation of castor and mulberry pests will help to eventually achieve an economically sound and efficient pest management strategy. Future research emphasis should be given due concern for the development of integrated/appropriate pest management strategies for economically important pests of silkworm feed plants for higher silk production and productivity. The major mulberry and castor growing areas of other parts of Ethiopia should be surveyed as the current survey is not inclusive of all areas due to logistic problems. Periodic surveys should be carried out to monitor the pest's status as production systems and environmental conditions are dynamics to regulate pest population and their economic importance.

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