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SURVEY, IDENTIFICATION AND CONTROL OF WEEDS ASSOCIATED WITH MULBERRY (*Morus spp.*) IN THE PROVINCES OF AURORA, LA UNION, ILOCOS SUR AND ILOCOS NORTE, PHILIPPINES

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ABSTRACT

Surveys, collections and identification of weeds were done in the sericulture projects of Sta. Maria, Ilocos Sur; Marcos, Ilocos Norte; Aurora, Aurora; and aat the SRDI, Bacnotan, La Union, in both wet and dry seasons. A total of 75 species of weeds were collected and identified. Survey, collection and identification of weeds in the sericulture projects of Sta Maria, Ilocos Sur;Marcos, Ilocos Norte; Ma. Aurora, Aurora; and at the Sericulture Research Development Institute in Bacnotan, La Union were done through quadrant sampling. Dominant weeds during the wet season in Sta Maria, Aurora, and Bacnotan were *Digitaria sp., Fimbristylis littoralis, Ageratum conyzoides and Cyperus rotundus* while during dry season, *Diqitaria sp., Chloris sp., Centrosema pubescens and Dactyloctenium aeqyptium* were the dominant weed species, respectively. On a per hectare basis, results showed mulching was found to be the most economical and beneficial weed control method. Total cost of weed control was P5,080.00 as against herbicide application with P7,224.00 and hand-weeding at P7,620.00.

Keywords: *Dominant weeds, Digitaria sp., Fimbristylis littoralis, Ageratum conyzoides and Cyperus rotundus, Digitaria sp., Chloris sp., Centrosema pubescens and Dactyloctenium aeqyptium*

I. INTRODUCTION

Many common weeds associated with mulberry plants in the Philippines are of foreign origin (Waterhouse, 1994). Examples are *Chromolaena odorata, Amaranthus spinosus, Portulaca oleracea, Eleusine indica, Euphorbia hirta, Mimosa pudica* and *Ageratum conyzoides.* So successful are the weeds in competing with mulberry plants since they have good competitive ability, do not require special environmental requirements for germination or growth of seeds or vegetative parts, produce large number of seeds, and develop of tolerance to different methods of control (Zimdahl, 1992). Yield reduction by weeds in a rice cropping season have been estimated to be 44-96% (Nyarko and de Datta, 1991).

Yield losses in unweeded shifting cultivation showed 28% in maize, 59% for Cowpea, 73% in Yam, 91% in sweet potato and 92% in cassava (ESCAP, 1994). In India, manual intercultivation is presently the widely accepted method of weed management in mulberry plantations involving large number of man-days (Mishra, et al., 1992). Hand- weeding is reportedly the oldest, labor intensive and the farmer's only means of controlling weeds for centuries (Kim, 1981). The amount of labor required to weed one hectare ranges from 10-30 days (Nyarko and de Datta, 1991).

Chemicals are used to control weeds in agricultural crops. On broadleaves, Bactrill can control *Ipomoea spp., Amaranthus spp.* and *Sida spp.* (Porter and Shepard, 1995). Butachlor and other chemicals can be used as pre-emergence herbicide in transplanted rice (Chiang and Leu, 1981). Farmers considereffectiveness and price as major factors in selecting herbicides (Estorinos, et al.,1995). Chemical control through the use of herbicides is the most important method presently adopted for weed control (Kusanagi, Hirono, 1981).

Other methods of controlling weed include mechanical (Ashton and Monaco, 1991), biological control (Kusanagi, 1981) and ecological control (Takasawa, 1981). Often, the best and most economical way to control weed is the wise combination of any two or more of the following

methods; mechanical and chemical for one year or continue any appropriate combination for several years according to Klingman and Ashton, (1975).

Like any other tropical countries, mulberry plants can be grown almost anywhere in the Philippines. Identification of the weeds associated with mulberry plants are, therefore important, in controlling the weeds. The objectives of this study were: (1) to identify and classify common weeds associated with mulberry plants at the Sericulture Research Development Institute (SRDI) and the SRDI- assisted sericulture community (ies) in the wet and dry seasons; and (2) to identify effective control measures against the weeds.

II. METHODOLOGY

Survey of Weeds. Mulberry plantation in Marcos, Ilocos Norte; Sta. Maria, Ilocos Sur; Aurora, Aurora; and at the SRDI, Bacnotan, La Union were surveyed for common weeds associated with established mulberry plants. The surveys were done in both dry and wet season of 1996.

Collection and Identification of Weed Samples. Using quadrats measuring 1m x 1m and ramdomly placed weed- infested areas of each of the plantations, all the weed species therein were uprooted, cleaned, and separately placed in plastic bags. There were five sampling sites per area taken during the two seasons. The weed species were taken to the Pest Clinic for sorting, identification, classification and dry matter weighing.

Control of Weeds. There were three control measures used, namely: manual method, mulching, and chemical method. Total area used was 160 sq.m. Measurement per treatment area was 10 sq. m.

Manual method. A person was assigned to do the de-weeding on a daily basis.

Mulching. Dried leaves of mulberry weeds and rice hay were used as mulching materials. These were placed as cover materials on all treatment plots. Thickness of mulch materials was about 2.54 cm. Only the mulberry plants can be seen standing on the plots.

Chemicals. Glycol (Round-up) was used as the herbicide at the rate of 2.5 kg. a.i. per hectare. A backpack sprayer was used to apply the herbicide.

Control. Unweeded plots served as the control treatment.

Design of the experiment. The experiment was done on a Randomized Complete Block Design (RCBD) in three replications.

III. RESULTS AND DISCUSSION

Results of the survey on common weed species associated with mulberry plants during the wet and dry seasons yielded a total of 75 weed species in the surveyed areas. Dominant weeds associated with mulberry plants in SRDI, Bacnotan, were *Dactyloctenium spp, Digitaria sp., Eleusine indica* for the wet season and *Trianthema portulacastrum, Cyperus rotundus* and *Amaranthus spinosus* for the dry season (Table 1).

In Marcos, Ilocos Norte, *Digitaria spp., Fimbristylis littoralis* and *Imperata cylindrica* were the more dominant weeds during the wet season with no dominant weeds during the dry season (Table 2). Dominant weeds in Sta. Maria, Ilocos Sur were *Dactyloctenium aegyptium,* and *Ipomoea triloba,* for the wet season while *Eleusine indica, Digitaria spp.,* and *Chromolaeana odorata* were the common weeds in the dry season (Table3).

In Aurora, the more dominant weeds were *Centrosema pubescens* during dry season while *Ageratum conyzoides, Digitaria sp.* and *Cyperus kyllingia* for the wet season (Table 4). Dominant weeds were those species which occurred in relatively greater number than the other species. Figure 1 shows the seasonal occurrence of some selected weed species in the surveyed areas in both dry and wet seasons in the region. Other local names of the weeds are shown in Table 5.

Comparison of weed control methods seems to show mulching as the better method since it had the cheapest inputs at P5,080.00 resulting to relatively better plants growth (Table 6). Herbicide application with glyphosate had labor saving advantages but seemed to have stunting effect on saplings. Glyphosate can control weeds 60-100 days from application (Hiroshi and Suzayaki, 1981).

Hand-weeding was labor intensive, hence the costliest method. Unweeded plants (control) yielded with chlorotic leaves. Mulching of mulberry plantations can result to better plant growth since it can conserve

moisture which the plants can use whenever needed especially during the summer months, the practice also encourages earthworm activities which conditions the soil to make it more usable to plants.

In large plantations when mulching materials are lacking, herbicide application may be more practical but appropriate chemicals should be used to control more weeds, with no adverse effects on the crops, must be environment-friendly, and should have reasonable cost. While small, less than a hectare, farmer-owned mulberry plantation can best be weed-free by using a combination of mulching and hand-weeding practices.

Any available mulching materials around the farm may be used. Stubborn weeds like *C. rotundus* can be minimized by hand weeding. Control strategies against weed depends on the plantation size, availability of mulches; efficacy, and side effects of herbicides; and cost of practices. Mulberry plantation owner may adopt any or a combination of the methods depending on his needs.

Table 1. Common Weeds Identified In Five 1m X 1m Quadrat Sampling Sites During Wet And Dry Seasons at The SRDI Mulberry Plantation, Bacnotan La Union, Philippines.

WEED SPECIES (SCIENTIFIC NAME)	COMMON NAME	FAMILY	CLASSI-FICATION	LIFE CYCLE	NUMBER		DRY MATTER WEIGHT (g)		DR %	
					WS	DS	WS	DS	WS	DS
Ageratum conyzoides L.	Bulak-manok	Asteraceae (Compositae)	Broadleaf	Annual	9		8.8			1.54
Amaranthus spinosus L.	Spiny amaranth	Amaranthaceae	broadleaf	Annual	13	17	15.5	23	4.4	2.71
Calopogonium sp. Beauv.	colopogonium	Papilionaceae (Leguminosae)	broadleaf	Annual		8		42		8.0
Centrosema pubescens B.	Centrosema	Papilionaceae (Leguminosae)	broadleaf	Annual		2		7		1.3
Cleome rutidosperma	Sili-silihan	Capparaceae	broadleaf	Annual		9		17		3.2
Commelina benghalensis L.	Lay flower	Commelinaceae	broadleaf	Annual		5		19		3.6
Corchorus olitorius L.	Saluyot	Tiliaceae	broadleaf	Annual	15	11	33.0	27	5.1	5.78
Cynodon dactylon	Bermuda grass	Poaceae	grass	Perennial	22		31.8			5.57
Cyperus rotundus L.	Purple nutsedge	Cyperaceae	grass	Perennial	14	28	3.0	10	1.9	0.52
Dactyloctenium aegyptium (L) *Beauv.*	Crowfoot grass	Poaceae	grass	Annual	130	10	172.3	42	8.0	30.21
Digitaria spp.	Large crab grass	Poaceae	grass	Annual	99		144.9			25.40
Echinocloa colona (L.) Link.	Jungle rice	Poaceae	grass	Annual	22	4	15.0	23	4.4	2.63
Elusine indica (L) Gaertn	Goose grass	Poaceae	grass	Annual	46	5	56.9	15	2.8	9.97
Euphorbia hirta L.	Gatas-gatas	Euphorbiaceae	broadleaf	Annual		7		17		3.2
Ipomoea triloba L.	Baging-baging	Convolvulaceae	broadleaf	Annual	4	3	5.0	8	1.5	0.87
Malvastrum sp.	malvastrum	Malvaceae	broadleaf	Annual	32		35.0			6.13
Mimosa invisia L.	Giant sensitive plant	Mimosaceae (Leguminosae)	broadleaf	Annual	12	6	30.0	28	5.3	5.26
Mimosa pudica L.	Makahiya	Mimosaceae (Leguminosae)	Broadleaf	Annual	10	6	19.1			3.34
Portulaca oleracea	Ulasiman	Portulacaceae	broadleaf	Annual		2		30		5.7
Trianthena portulacastrum L.	Toston	Aizoaceae	broadleaf	Annual		25		205		39.3

Table 2. Common weeds identified in five 1m x 1m quadrat sampling sites During Wet And Dry Seasons at the mulberry plantation, Marcos, Ilocos Norte, Philippines.

WEED SPECIES	COMMON NAME	FAMILY	CLASSI-FICATION	LIFE CYCLE	NUMBER		DRY MATTER WEIGHT (g)		DR %	
					WS	DS	WS	DS	WS	DS
Borreria ocymoides	Sik-sik parang	Rubiaceae	broadleaf	Annual	3		5.0		.94	
Chloris sp.	Chloris	Poaceae (Graminae)	grass	Annual	1	3	26.1	37	4.94	45.6
Chromolaena odorata (L.) King and Robertson	Devil weed	Asteraceae (Compositae)	grass	Perennial	2		146.2		27.67	
Cleome rutidosperma	Sili-silihan	Capparaceae	broadleaf	Annual		2		3	3.7	
Dactyloctenium aegyptium (L) *Beauv.*	Crowfoot grass	Poaceae (Graminae)	grass	Annual	4		15.0		2.83	
Digitaria spp.	Large crab grass	Poaceae (Graminae)	grass	Annual	13	2	53.3		10.09	
Elusine indica (L) Gaertn	Goose grass	Poaceae (Graminae)	grass	Annual	3	2	11.2	13	2.12	
Fimbrisylis littoralis Gaudich.	Fimbristylis	Cyperaceae	sedge	Annual	14		159.0		30.10	
Imperata cylindrical P.	Talahib	Poaceae (Graminae)	grass	Perennial	10	2	26.0		4.92	
Mimosa invisia L.	Giant sensitive plant	Mimosaceae (Leguminosae)	broadleaf	Perennial	1		48.0		9.08	
Mimosa pudica L.	Makahiya	Mimosaceae (Leguminosae)	broadleaf	Perennial	2		5.0		.94	
Setaria geniculata	Cat's tail	Poaceae (Graminae)	grass	Annual	1		33.4		6.32	

Table 3. Common weeds identified in five 1m x 1m quadrat sampling sites During wet and dry seasons at the mulberry plantation, Sta. Maria, Ilocos Sur.

WEED SPECIES	COMMON NAME	FAMILY	CLASSI-FICATION	LIFE CYCLE	NUMBER		DRY MATTER WEIGHT (g)		DR %	
					WS	DS	WS	DS	WS	DS
Centrosema pubescens B.	Centrosema	Papilionaceae (Leguminosae)	broadleaf	Annual	6		6			0.6
Chloris sp.	Chloris	Poaceae (Graminae)	grass	Annual	2	3	30.0	31.5	36.14	5.4
Chromolaena odorata (L.) King and Robertson	Devil weed	Asteraceae (Compositae)	grass	Annual	13		178.0			18.9
Dactyloctenium aegyptium (L) *Beauv.*	Crowfoot grass	Poaceae (Graminae)	grass	Annual	7	4	9.2	15	11.08	1.5
Digitaria sanguinalis (L.) Scop.	Crab grass	Poaceae (Graminae)	grass	Annual	4	31	5.0	310	6.02	32.8
Elusine indica (L) Gaertn	Goose grass	Poaceae (Graminae)	grass	Annual	21					
Fimbrisylis littoralis Gaudich.	Fimbristylis	Cyperaceae	broadleaf	Annual	7		146			15.4
Imperata cylindrica	Talahib	Poaceae (Graminae)	grass	Perennial	5		98.7			10.4
Ipomoea triloba L.	Baging- baging	Culvulvolaceae	broadleaf	Annual	5		7		8.43	
Leptocloa sp.	Palay-maya	Poaceae (Graminae)	grass	Annual	2		31.8		38.31	
Mimosa invisia	Giant sensitive	Papilionaceae (Leguminosae)	broadleaf	Annual	1		48		5.0	
Mimosa pudica	Makahiya	Papilionaceae (Leguminosae)	broadleaf	Annual	4		12			1.2
Seteria geniculata	Cat's tail	Poaceae (Graminae)	grass	Annual	4		43			4.4

Table 4. Common weeds identified in five 1m x 1m quadrat sampling sites During wet and dry seasons at the Ma. Aurora mulberry plantation, Aurora Province.

WEED SPECIES	COMMON NAME	FAMILY	CLASSI-FICATION	LIFE CYCLE	NUMBER		DRY MATTER WEIGHT (g)		DR %	
					WS	DS	WS	DS	WS	DS
Tridax procumbens L	Bulak-manok	Asteraceae (Compositae)	broadleaf	Annual	81	2	143.3	10.0	64.2	4.68
Calopogonium sp. Beauv.	Colopogonium	Papilionaceae (Leguminosae)	broadleaf	Annual	3		10.5		4.7	
Centrosema pubescens B.	Centrosema	Papilionaceae (Leguminosae)	broadleaf	Perennial	8	12	7	91.5	3.4	42.82
Cleome rutidosperma	Sili-silihan	Capparaceae	broadleaf	Annual	10	3	3.4	2.5	1.5	1.17
Colocasia esculentum	Gabi	Araceae	broadleaf	Annual	2		8.09			8.09
Cyperus killingia	Cyperus	Poaceae (Graminae)	sedge	Annual	48		20		8.9	
Digitaria sp.	Kaludgangan	Poaceae	grass	Annual		24		24.3		10.9
Ipomea triloba L.	Kamote-kamotehan	Convolvulaceae	broadleaf	Annual	10		14.4		6.4	
Rottboellia exalta L.F.	Marapagay	Poaceae (Graminae)	grass	Annual	2		17.0			7.95
Stachytarpeta jamaicensis	Kandila-kandilaan	Verbenaceae	broadleaf	Annual	2		11.3			5.29
Unidentified fern	Fern		broadleaf	Perennial	5		64.0			29.96

Table 5. Other local names of weeds in the Philippines

Scientific name	Local Name
Fimbristylis littoralis Gaudich.	Ubod-ubod, taulat (Tagalog), Gumi (Pangasinan) Sirau-sirau (Ilokano), Sirisibuyas (Bikolano)
Echinocloa colonum (L.) Link	Bulang, pulang puit (Tagalog), Dukayan (Ilokano) Tumi (Bontoc)
Leptocloa sp.	Malapalay (Tagalog)
Cyperus rotundus L.	Balisañga (Ilokano), Boto-botones (Bikolano) Mala-apulid, sur-sur (Pampango), Mutha (Tagalog) Malapandang (Bisaya)
Amaranthus spinosus L.	Akum (Mindanao), Ayantoto (Pampango), Tadtad (Bontoc), Alayon (Ifugao), Orai (Tagalog), Kulitis (Bisaya), Kalunay (Ilokano), Kilitis (Bikolano)
Rottboellia exaltata L.F.	Aguingay (Bisaya, Tagalog), Annarai (Ivatan) Nagei (Bontoc), Gaho,(Bikolano), Girum (Bagobo) Sagisi (Ilokano)
Eleusine indica (L.) Gaertn.	Dinapaiuk (Ifugao), Bakis-bakisan, pangis, sabung-sabungan (Tagalog), Bag-angan (Bikolano) Bikad-bikad (Suluano), Bila- bila, palagtiki (Bisaya) Parañgis (ilokano)
Digitaria sanguinalis (L)Scop	Saka-saka (Ilokano), Pagpagai (Bontoc)
Dactyloctenium aegyptium L. Beauv.	Krus-krusan (Tagalog)
Chromolaena odorata (L) King and Robertson	Daladay, gonoi, hulo-hanunoy (Tagalog) Lahumeri (Badjao)

Cont'n..Table 5. Other local names of weeds in the Philippines

Commelina benghalensis L.	Alikbangon (Tagalog), Bias-bias (Pampanga) Sabilau (Bisaya), Kuhasi (Ivatan) Kulkulasi (Ilokano)
Ageratum conyzoides L.	Asipakpuk (Pangasinan), Bahu-bahu (Suluano), Bahug-bahug (Bisaya), Budbuda (Igorot), Bulak-manok (Tagalog), Kahaldig (Bontoc), Kamabuag (Ivatan), Kulong-kogon babae (Bikolano)
Trianthema portulacastrum L.	Ayam, ulisam (Bisaya), Tostom (Tagalog)
Tridax procumbens	
Portulaca oleracea L.	Alusiman (Bikolano, Bisaya), Bakbakad (Ifugao), Dupdupel (Bontoc), Ulasiman (Tagalog), Kantataba (Pangasinan) Ñgalug (Ilokano)
Mimosa pudica L.	Bain-bain (Ilokano), Makahiya (Tagalog) Hiyom-hiyom, tuyag-tuyag, kirom-kirom Hiya-hiya (Bisaya), Sipag-sipag (Subanon) Torog-torog (Bikolano)
Ipomoea triloba L.	Kamku-kamutihan (Tagalog), Kamkamote (Ilokano), Muti-muti (Bisaya), Sagikat (Bagobo)
Cleome rutidosperma DC.	Kandila-kandilaan (Tagalog)

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Figure 1. Some weed species found in the four mulberry plantations surveyed: (a) *Borreria ocymoides* (b.) Vernonia cinerea (L) Less (c.) *Ruellia spp*(d) *Malvastrum sp.* (e.) *Ageratum conyzoides* L; (f.) *Rottboellia exalta* L.F. (g) *Euphorbia heterophylla*; (h.) *Tridax procumbens* , (i) (k) *Cleome rutidosperma*

Table 6. Comparative analysis of methods of weed control.

CONTROL METHOD	INPUT COST	ADVANTAGE	DISADVANTAGE	REMARK
Handweeding[1]	P7,620.00	Effective	Labor-intensive	Normal plant growth
Herbicide application[2]	P7,224.00	Labor-saving	May be harmful to the environment; backpack sprayer needed	Seems to have stunting effects on plants
Mulching[3]	P5,080.00	Conserves, moisture, control most weed, promotes, earthworm activities, prevents leaching	Cyperus rotundus still thrives	Relatively healthier leaves, normal sapling growth
Unweeded (Control)	None	No inputs	Very weedy, can be sources of pathogens; weeds compete with mulberry plants for space, nutrients, sunlight, water	Normal sapling growth slightly yellowish leaves

Note: Computation was based on: (a) P 127 wage / day and (b) one hectare mulberry plantation ; (1) Assuming one person weeds 500 sq. m. or 20 persons/ha/d 3x in 3 consecutive months.(2) Applied at 2.5 ai kg/ha or 3.5 1/ha (at P400/liter) 4 persons employed /d/ha at 3x in 3 consecutive months; cost of knapsack sprayer, P 1,500.00, and (3) One application in a 3- consecutive month period (20 persons/ha/d to gather mulches and 20 persons/ha/d to apply mulches)

IV. SUMMARY AND CONCLUSION

Surveys, collections and identification of weeds were done in the seri-projects of Sta. Maria, Ilocos Sur; Marcos, Ilocos Norte; Aurora, Aurora; and aat the SRDI, Bacnotan, La Union, in both wet and dry seasons. A total of 75 species of weeds were collected and identified. *Digitaria sp. ; F. littoralis, A.conyzoides, C. pubescens and D. aegyptum* were the dominant weeds identified during the wet and dry seasons. A total of 75 weedspecies were collected during the survey covering the sericulture projects in Sta. Maria, Ilocos Sur; Marcos, Ilocos Norte; Aurora, Aurora; and at the SRDI, Bacnotan, La Union. Dominant weeds in Sta. Maria were *Digitaria sp*. and *Dactyloctenium aegyptium; Chloris sp* and *Fimbristylis littoralis* Gaudich in Marcos; *Centrosema pubescens* Benth. and *Cyperus killingia* and *Cyperus rotundus* L. and *Dactyloctenium aegyotium* at SRDI, Bacnotan, La Union. Among the weed control methods tested, mulching seemed to be the cheapest at P5,080.00 followed by herbicide application with P7,220.00 and hand weeding, P7,620.00. Each method had its own advantages and disadvantages. Weed control strategies in mulberry plantations depended on planrtation size, availability of mulches,efficacy and side effects of herbicides, and cost of the method. Any combination of the methods over a period may be suitable according to the needs of the plantation owner. Smaller plantations may use mulching and handweeding for example.

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