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Results of a Preliminary Survey in Cameroon, Central Africa, for Potential Natural Enemies of Guineagrass, *Panicum maximum*

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ABSTRACT

Guineagrass, *Panicum maximum* Jacq. (Poales: Poaceae), is an invasive weed in South Texas in subtropical perennial crops, rangelands, natural areas, roadsides and urban areas. Biological control could be a viable method for management of *P. maximum* if the limited uses of this invasive plant as forage can be resolved. Preliminary surveys were conducted in the native range of guineagrass, in Cameroon, Africa to collect and identify the herbivore insects associated with this grass. Several insects including, several beetle species in the families Alticidae, Chrysomelidae (Criocerinae) and Riocerinid and a moth in the family Geometridae were collected from *P. maximum* that have potential as biological control agents.

Additional index words: Lower Rio Grande Valley of Texas, biological control of weeds, invasive grasses.

The natural distribution of Guineagrass, *Panicum maximum* Jacq. (Poales: Poaceae), is confined to the intertropical area of Africa from Senegal in the west to Mozambique in the east including a part of the south east coast and Madagascar (Fig.1) (USDA-GRIN 2009). *Panicum maximum* was introduced as a forage plant to almost all tropical countries, where it has widely invaded lands and pastures and displaced native grasses (Fig 2). It has become an important invasive weed in the southern states of the US (Wunderlin and Hansen 2008), and in particular in south Texas, where it is highly invasive in natural areas, highway right-of-ways, and in plantations of citrus and sugar cane (Texas Invasives 2006; Everitt et al. 2007), as recorded by the sugarcane growers and organic citrus producers in the Lower Rio Grande Valley. Herbicidal, mechanical and cultural control of *P. maximum* in these crops is very expensive, time consuming and largely ineffective. Biological control could be a viable method for management of *P. maximum* if the limited uses of this invasive plant as forage can be resolved. This paper describes the results of a preliminary survey for natural enemies of *P. maximum* in Cameroon, central Africa that could form the basis for a biological control program.

MATERIALS AND METHODS

Exploration. Exploration for natural enemies of *P. maximum* was conducted in Cameroon, where it is native and commonly encountered. Cameroon is highly suitable for surveys as *P. maximum* is common in the degraded forest habitat. It is able to grow in 50% shade and full sun and needs a minimum of 850 mm annual rainfall. The survey route was planned to survey many locales for *P. maximum* covering different habitats and altitudes from sea level to 750 m. The different localities were a minimum of 40 km apart. This survey took place from 11 to 18 May 2009. The reason for making this survey in May was because *P. maximum* was at the right phenological stage, exhibiting green foliage and inflorescences after heavy rain; inflorescences are an important feature for distinguishing *P. maximum* from more than forty other similar- looking Poaceae in this region.

Collection Methods. All the insects were collected from visual observations of feeding or resting directly on *P. maximum*. At the same time, damaged leaves, inflorescences, stems and roots were harvested. The insects collected from plants were

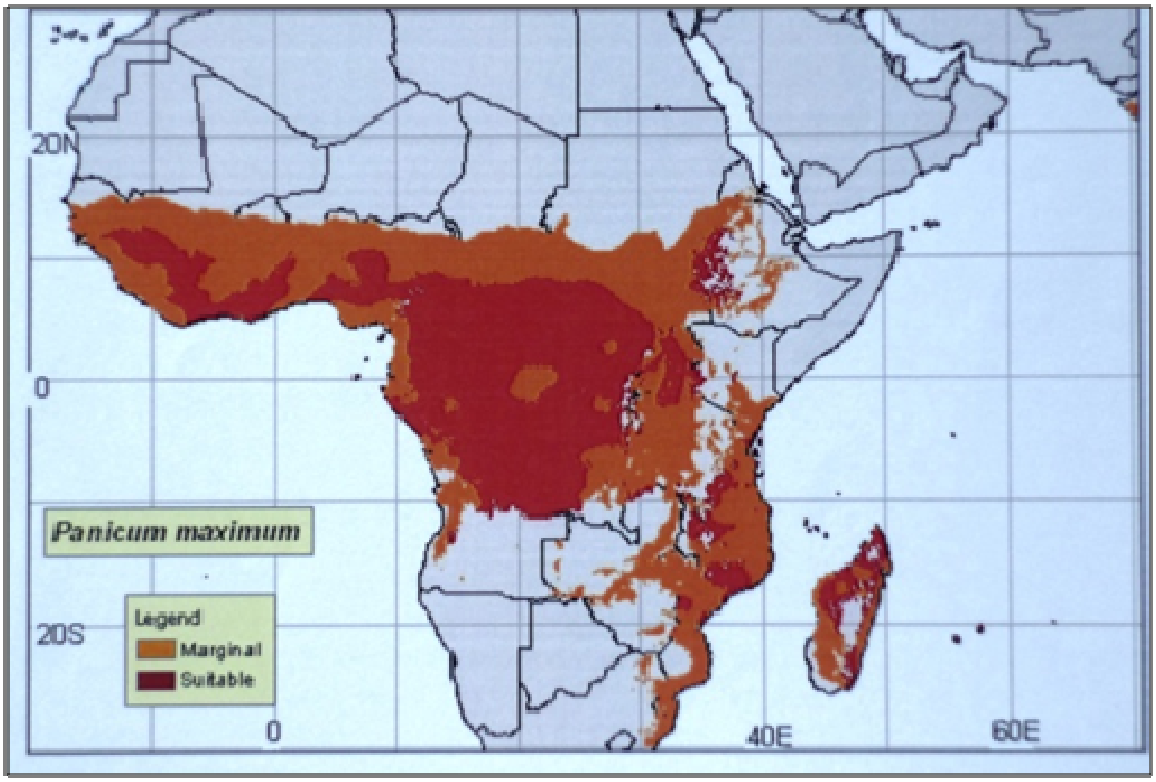

Fig 1. Map of *Panicum maximum* distribution in Africa.

Fig 2. G. Mercadier next to stand of roadside guineagrass, *Panicum maximum* near Mission, TX.

placed in labelled vials containing 75° alcohol. Vials of insects were returned to EBCL in Montpellier, France. Specimens were identified with the help of the systematic service of CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement). Field-harvested plant parts were transferred to clear plastic gauze covered containers (1.5 L) of which were kept cool until arrival at the JT laboratory in Yaoundé, where they were observed and emerged insects collected by Wenceslas Yana, a student in entomology of the University of Yaoundé. Each container was labelled with collection date and locality. Philippe Le Gall (University of Yaoundé) identified the insects which emerged in these boxes. Insects were identified using taxonomic guides (Blezynski 1970; Laporte 1973; Meijerman and Ulenberg 1996; Holloway 1998; Songa et al. 1998; Polaszek and Khan 2000; Epinette 2003; Gounou and Schulthess 2004; Le Rü et al. 2006a and 2006b)

RESULTS

Panicum maximum was found growing in forest areas in 21 sites in Cameroon (river banks, along dirt roads, border fields, garden around villages etc) from sea level to 750 m (Table 1). It was never absent wherever we stopped, although it was never a dominant plant, always appearing to be mixed with other vegetation and crops. The size and aspect of *P. maximum* in Africa is different from North American *P. maximum*, as it is larger and more robust in Africa but density is far lower.

The coleopterans were the most abundant with ten different families and with a predominance of the Chrysomelidae represented by seven subfamilies (Table 2). The pentatomid, *Carbula melanacantha* (Hemiptera) was the most common insect, collected in eight localities out of twenty-one. Among the moths (Lepidoptera), the ctenuchid, *Syntomis* sp. was collected in large numbers in ten localities, and the crambid, *Chilo* sp. was the main stem borer, causing damage in fourteen localities with emergence of adults from four of these. Two other lepidopterans found in small numbers appeared promising, including a female of an unidentified species in the Notodontidae found laying a large quantity of eggs directly on an inflorescence of *P. maximum*, and some larvae of a geometrid (localities 8 and 19) causing a large amount of damage to the floral stems.

Table 1. Numbered collection localities in Cameroon .

N^{O}	Localities	GPS Data
1	Minkoameyos, west of Yaoundé, alt.740m	03°52’29’’N-11°25’42’’E
2	Nkomekui, west of Yaoundé, alt.728m	03°51’01’’N-11°20’10’’E
3	Okong, west of Yaoundé, alt.725m	03°49’36’’N-11°15’10’’E
4	Nkol-Oveng, west of Yaoundé, alt.708m	03°46’57’’N-11°14’56’’E
5	Nsimalen, south of Yaoundé, alt.673m	03°43’14’’N-11°32’07’’E
6	Ekali, south of Yaoundé, alt.654m	03°38’21’’N-11°32’15’’E
7	Zamakoe, south of Yaoundé, alt.685m	03°35’23’’N-11°30’38’’E
8	Forest School of Mbalmayo , alt.696m	03°29’11’’N-11°30’05’’E
9	Nkoluguete, south of Mbalmayo, alt.664m	03°25’12’’N-11°31’10’’E
10	Nkolugok, south of Mbalmayo, alt.677m	03°17’15’’N-11°26’16’’E
11	Babang, south of Mbalmayo , alt.683m	03°08’12’’N-11°24’44’’E
12	Ebolowa, south of Mbalmayo, alt.662m	02°54’45’’N-11°10’50’’E
13	Ngomessane, south of Mbalmayo, alt.707m	02°57’59’’N-11°24’02’’E
14	Manyia, west of Yaoundé, alt.517m	03°49’15’’N-11°01’11’’E
15	Boga, west of Yaoundé, alt.518m	03°53’17’’N-10°46’49’’E
16	Pouma, west of Yaoundé, alt.149m	03°51’15’’N-10°31’24’’E
17	Song-Dong, west of Yaoundé, alt.105m	03°48’18’’N-10°14’58’’E
18	Kribi, south Edéa, alt.8m	02°58’03’’N-09°54’54’’E
19	Ebéa, south Edéa, alt.12m	03°10’28’’N-10°01’40’’E
20	Mbebe, south Edéa, alt.17m	03°24’30’’N-10°07’11’’E
21	Koukoe, south Edéa, alt.43m	03°40’54’’N-10°06’29’’E

Table 2. List of insects found on *Panicum maximum* in Cameroon.

Order	Family	Species	Localities N^{O}
Coleoptera	Chrysomelidae		
	Alticinae	*Decaria glabrella* (Dalman)	11
	Clytrinae	*Gynandrophthalma* sp.cf. *elongata*	13, 14
	Clytrinae	*Gynandrophthalma* sp.cf *immaculata*	21
	Criocerinae	*Lema* sp.	21
	Cryptocephalinae	*Cryptocephalus lowii* Suffrian	6, 9, 12, 16
	Eumolpinae	*Syagrus* sp.	3
	Galerucinae	*Sesselia* sp.	17
	Galerucinae	*Monoloepta elegans* Allard,	20
	Hipinae	*Dactylispa spinulosa* (Gyllenhall)	19
	Corylophidae	unidentified sp.	7
	Curculionidae	unidentified sp.	15, 17, 19
	Curculionidae		
	Scolytinae	unidentified sp.	11
	Languriidae	*Clerolanguria tricolor* (Fabricus)	11
	Lycidae	*Lycus* sp.	10
	Meloidae	*Epicauta spurcaticollis* (Fairmaire)	16, 17
	Melyridae,		
	Malachiinae	unidentified sp.	7, 10, 11, 13, 14
	Nitidulidae-1	unidentified sp.	4
	Nitidulidae-2	unidentified sp.	5
	Rhipiphoridae	unidentified sp.	19
	Tenebrionidae,		
	Lagriinae	unidentified sp.	5,11
Heteroptera	Lophopidae	*Elamoscelis cimicoides* Spinola	11,19, 21
	Pentatomidae	*Carbula melanacantha* (Fabricius)	8, 9,10,11, 13,14,15,20
	Cydnidae	unidentified sp.	2
Lepidoptera 6,7,13,19	Crambidae	*Chilo* sp.	
	Ctenuchidae	*Syntomis* sp.	3,7,8,13,14, 16,17,19,20,21
	Notodontidae	unidentified sp.	17
	Geometridae	unidentified sp.	8, 19

DISCUSSION

More than 300 attempts have been made worldwide to control weeds using biological control (Julien and Griffiths 1999). However, no attempts had been made to target grassy weeds with phytophagous insects until the current *Arundo donax* (giant reed) biological control program in the USA (Goolsby and Moran 2009). Several host-specific insects were found associated with *Arundo* after several years of foreign exploration and quarantine testing (Goolsby and Moran 2009; Goolsby et al. 2009), and now two have been recommended for field release. For *P. maximum*, the preliminary survey for natural enemies revealed a rich insect fauna, although many will not be sufficiently host specific to be considered as biological control agents. Of these associated insects, the alticid and chrysomelid (Criocerinae) riocerinid beetles and geometrid moths, come from groups that have been successfully used in biological control of non-grassy weeds (Julien and Griffiths 1999) and warrant additional study. Further work will include collections of natural enemies from *P. maximum* and associated Poaceae to evaluate field host specificity. Additional collections are needed throughout these tropical and subtropical regions of Africa because some host-specific herbivorous insects may be regionally rare but locally common (Price et al. 1995). Additional field work will be needed to narrow down the insect fauna to potentially host specific natural enemies of *P. maximum*. Regular collections during wet and dry seasons will help elucidate the phenology and field biology of these herbivore insects. Intensive collections are also needed from the rhizosphere of mature and seedling *P. maximum* to search for below ground herbivores that may be important in regulating the growth and regenerative capacity of the plant. Lastly, additional foreign exploration for natural enemies of *P. maximum* is needed throughout its range in Africa to determine the distribution and climatic tolerances of key herbivores and to collect additional plant material for molecular characterization.

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