Non-domesticated Plants Often Overlooked in the Archaeological Record:

Paleoethnobotanical Evidence from the Hart and Ward Sites in Kentucky

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Abstract: The current paper will address the importance of certain plants that are commonly found but overlooked in the archaeological investigations of sites. The potential use as food of plants recovered from the archaeological record but not usually considered in debates often focused on domesticate versus non-domesticate plant use will be addressed. These plants include purslane (*Portulaca oleracea*), oxalis (*Oxalis stricta*), and Solomon's Seal (*Polygonatum* spp.) New botanical evidence recovered from two sites, the Hart Site and the Ward Site, located in eastern and western Kentucky will be presented. Continued evidence for the early utilization of *Chenopodium* will also be addressed in terms of food uses not usually stressed in the literature.

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Introduction: The Importance of Non-domesticated Plant Use

The importance of non-domesticated plants in human strategies of understanding and surviving in the world is often over-looked in archaeological and ethnographic studies of human-plant relationships. Non-domesticated plants, in general, have taken a second seat to plants that have undergone domestication. This under-valuing of wild and other non-domesticated plants is due to the fact that domesticated plants make up the bulk of the food that is consumed by most humans in the world today. This fact, however, does not lessen the need to understand how, when, where, and why non-domesticated plants are utilized by members of different societies both in the past and present. The current paper will address the importance of certain plants, which are often found in the archaeological record but just as often ignored, in terms of their potential meaning in human strategies of plant use (Bonzani 1997).

Some attention was paid to the importance of non-domesticated plants in American anthropology with Anderson's (1952) ideas concerning the origins of agriculture and his "dump heap" theory. This approach brought up the issue that weedy plants played a significant role in the origins of agriculture and that these types of plants were at the beginning of the process of domestication. Harlan (1975) further refined the differing degrees of human interactions with plants by delineating the terms: domesticated, semidomesticated, cultivated, managed and wild. This categorization helped to formulate later hypothesis that domestication was indeed the end product of a long process of human-plant interactions which first began with wild or weedy plants (Rindos 1984). Ford (1985) clearly discusses the process of domestication as a long continuum that begins with the use of wild plants or noncultigens. As tending and cultivation increase, wild and weedy plants undergo continued manipulation by humans that eventually results in domestication. Unfortunately, the majority of articles written on plant use almost exclusively focus on the domesticated species to the exclusion of non-domesticates. For instance, an outline of the sites and earliest dates of recovery of domesticated plants in the "eastern agricultural complex" predominate the literature with only cursory mention of other plants (i.e. purslane, oxalis, grasses) which also are recovered archaeologically and no doubt played a role in human strategies of food choice (Gremillion 1997; Smith 1992). The importance of these works is not in question; however, scholarly research and collaboration needs to be directed towards these "other" plants, as well.

Recent ethnobotanical studies (Etkin 1994; Bye 2000; Voeks 1997) have begun to stress the importance of wild and other non-domesticated plants to peoples throughout the world. These studies focus on the use of such plants to reduce the stress of seasonal shortfalls in food supplies; on the different types of uses found for wild plants; on the importance of non-domesticates in the medical pharmacology of groups; and on their use in ideological/religious belief systems. All of these studies view non-domesticated plants as having an integral part in the ideological and economic strategies by which peoples manage their world.

The current paper will utilize the botanical remains recovered from two sites in Kentucky to begin to address the issues of the importance and use of non-domesticated plants as found in the archaeological record. These sites include the Ward Site (15McL11) which is located in the Green River Valley of western Kentucky, and the Hart Site (15La183), located along the Big Sandy River in Lawrence County, eastern Kentucky. Most of the Ward Site was excavated in 1938 by WPA archaeologists. Recent preliminary excavations there were carried out to recover samples of materials not collected by the WPA, including flotation samples. The recent excavations were done by the second author and George Milner of the Pennsylvania State University in the midden area of the site. Two test units were excavated from which seven flotation samples were analyzed for this paper. The site is part of the Shell Mound Archaic complex and the sites in this complex are dated to the late Middle and Late Archaic time periods at approximately 3500 to 1500 B. C. (Jefferies 1996). The Hart Site was excavated as Phase II and III mitigation efforts by the archaeological firm of Cultural Resource Analysts, Inc. in Lexington. The excavations were carried out under the field supervision of the third author and included the recovery of thirty-three flotation samples representing 27 features, one post mold and one unit sample (Unit 41/42). Both subsurface and surface features were encountered. This paper addresses the botanical remains recovered from the surface features which tentatively date from the Late Archaic through Woodland time periods in eastern North America.

Methodology

Flotation samples were processed at the offices of the Cultural Resource Analysts, Inc. in Lexington using the R. J. Dausman Technical Services, Inc. Flote-Tech system. This system allows for both a "light" fraction and "heavy" fraction to be collected. The light fraction is the carbonized material that floats up in the water and is collected after the soils are poured into the system. The heavy fraction are those materials which do not float and are collected in a fine screen at the bottom of the container into which the soils are initially poured. Experiments on efficiency of recovery done on the machine yielded a 74 to 80 percent recovery rate, which is within acceptable limits (Pearsall 1989; Wagner 1982). No cross contamination between samples occurred. The current analysis reports on botanical materials recovered from both the light and the heavy fractions.

Prior to sorting, all light fraction and heavy fraction samples were weighed. The light fractions from each sample are then gently sifted through a nested series of geological sieves (mesh sizes 2mm, 1mm, and 500µm). This procedure facilitates sorting by producing three fragment size classes: >2mm, 2mm – 1mm, and <1mm. Heavy fractions are also processed in the same manner.

All carbonized material in the >2mm size screen was sorted by count and weight into constituent material categories (e.g., nutshell, wood charcoal, seeds). Nutshell and seeds were then further quantified by genus/species. Carbonized plant materials retained in the 1mm and 500µm mesh screens and catch basin were scanned using an Olympus binocular microscope at a magnification of 10x. Any seeds, fleshy fruits (e.g., *Cucurbita* rind), etc. were removed, counted, and weighted by taxon and type of material.

Identification of plant remains was done by using an Olympus binocular microscope at magnifications of 7x for materials <2mm and at 10 to 20 x for materials >2mm. Identifications were substantiated by using the reference collection in possession of the first author. Secondary sources included various identification manuals (Martin and Barkley 2000; Montgomery 1977; Muenscher 1955; Panshin and de Zeeuw 1980; Young and Young 1992).

Results

At the Ward Site (15McL11) 15 flotation samples from two units (Units A and B) of the midden area were collected. Of these, seven samples were analyzed for botanical remains for the present paper. Total flotation volume from the seven samples analyzed was 34.7 liters. At the Hart Site (15La183) thirty-three flotation samples were recovered representing 27 features, one post mold and one unit sample (Unit 41/42). Total flotation volume from the 33 samples analyzed was 392.5 liters. Both light and heavy fractions from each sample from both sites were analyzed.

For the preliminary study of seven samples analyzed from the Ward Site, 231 carbonized seeds/fruits were recovered from the light fractions, as well as were one carbonized grass rachis, one carbonized flower head, 369 uncarbonized seeds, 28 insect remains, 1,105 mollusk shells and nine bone fragments. Only the carbonized plant remains were identified (Bonzani 2001a). The uncarbonized remains are generally treated as present-day contamination that usually enters a sample during its recovery from the field. Of the carbonized seed/fruit and nut remains recovered, 15 families, 16 genera and nine species are represented. One unidentified carbonized seed was also recovered.

From the 33 samples analyzed from the Hart Site, 1,844 carbonized seeds/fruits were recovered from the light and heavy fractions, as well as were 1,689 uncarbonized seeds, 554 insect remains, 51 mollusk shells and 30 unidentified fragments of carbonized botanical material (Bonzani 2001b). Only the carbonized plant remains were identified. Of the carbonized seed/fruit and nut remains recovered, 18 families, 23 genera and nine species are represented. Two unidentified carbonized seeds were also recovered.

A number of important aspects of plant use and seasonality were obtained from the analyses of the botanical remains from the Ward and Hart Sites (see Bonzani 2001a, 2001b). However, the current paper will focus on the results of these analyses in terms of the recovery of non-domesticated plant remains. One unusual aspect of the botanical remains from the Ward Site is the recovery of a relatively large number of chenopod (*Chenopodium* cf. *bushianum*)(n=80) and purslane (*Portulaca oleracea*)(n=37) carbonized seeds (Table 1, Figure 1). Another interesting recovery was that of yellow wood sorrel (*Oxalis stricta*)(n=5). These genera were only rarely identified in remains recovered from other sites in the west-central Kentucky area dated to approximately this time period. These sites include Carlston Annis, Bowles, Wan's Floodplain site, York-Render sites, Deweese and Haynes sites and Peter Cave (see Crawford 1982;Crothers 1999; Hensley 1994). Only one *Chenopodium* seed is recorded for these sites except for Peters Cave where 35 percent of the carbonized seeds are chenopods (Crawford 1982). These seeds were recovered from Peter Cave in levels comparably dated to those at Salts Cave (levels 11 through 4) that date to the Early Woodland (1,000 B.C.) and are, therefore, most probably from contexts slightly later than those under discussion for the Ward Site (2,500 to 1,500 B.C.)(please see Smith 1992; Watson 1969; Asch, Ford, and Asch 1972; Crites and Kerr 1990; Gremillion 1997; Kerr and Creasman 1995; Riley and Rossen 1990; Rossen and Edging 1987; Struever and Vickery 1973;Wymer 1992; Yarnell 1986; Cowan et al. 1981 for information on chenopod and other remains found in the northeastern United States). Archaic sites in eastern Kentucky also rarely have high numbers of *Chenopodium* seeds recovered. For instance at Newt Kash Rockshelter, 18 seeds of *Chenopodium berlandieri* are listed as being recovered from the site (Gremillion 1997a). Eighty seed or seed fragments alone of *Chenopodium* were recovered from the seven samples analyzed at the Ward Site with the majority found in the lowest level excavated (Level 4, 30-40 cm).

In regards to purslane, only a total of seven seeds are recorded for the Green River Shell Mound Archaic sites while at the Ward Site 37 seeds were recovered in the samples analyzed (Bonzani 2001a). Three seeds of purslane have been recovered in Early Archaic contexts in the Lower Little Tennessee River Valley (Chapman and Shea 1981; Chapman et al. 1974). The recovery of purslane in Woodland sites is more frequent (Yarnell 1986; Asch and Asch 1981), although still relatively rare. An example of this is indicated by the botanical analysis of 99 aboriginal sites dated from the Early Archaic through Late Woodland located in the Paintsville Reservior region of eastern Kentucky where no remains of purslane or oxalis were identified (Adovasio et al. 1982). Oxalis also was not identified in any of other the references consulted (see Chapman and Shea 1981; Crawford 1982; Crothers 1999; Hensley 1994; Smith 1992; Yarnell 1986), although five seeds were recovered from the Ward Site (Bonzani 2001a).

If these seed remains represent a natural inclusion in the archaeological record of a weedy plant growing in the vicinity of human habitation, then comparable numbers of seeds should be found at other sites in similar environmental conditions. This uniformity between sites, however, does not exist. Therefore, given the differences in the recovery of these taxa from the various sites, it is unlikely that the seeds from the Ward site are only natural environmental inclusions. They most probably instead represent an artifact of human plant use at the time the Ward Site was occupied.

The chenopod seeds recovered from the Ward Site also appear to be non-domesticated and are tentatively assigned to *Chenopodium* cf. *bushianum* based on criteria outlined by Smith (1984, 1992) and Gremillion (1993). The non-domesticated status of the majority of these seeds was recently confirmed by Bruce Smith (Smith, personal communication 2001). The criteria include cross-sectional shape, testa patterning, prominence of beak, and seed diameter. All but one of the chenopod seeds and fragments recovered from the Ward site has rounded to lens-shaped cross sections unlike domesticated varieties that are truncate in cross-sectional shape. The specimens have an areolate to reticular testa surface pattern, unlike domesticated varieties that tend to be smooth to puncticulate. These specimens also tend in the majority of cases to have a less prominent beak than do seeds of the cultigen type. A definitive determination of species, based on the thickness of the seed coat or testa, however, could not be made at this time. Therefore, only a tentative identification as *Chenopodium* cf. *bushianum* is offered since the mean maximum fruit diameter of all of the specimens recovered is 1.5 millimeters which corresponds to the mean maximum fruit diameter reported for wild specimens of *Chenopodium bushianum* (Smith 1992: 144-145, Table 6.1). This identification, if born out, would support Yarnell's (1986) hypothesis that all of the chenopods in the eastern Woodlands at various stages of domestication were derived from the native *C. bushianum*.

Given that the chenopods, purslane, and potentially even yellow wood sorrel, were most likely utilized by the human inhabitants, the evidence from the Ward Site points to a use of wild non-domesticated plants. The use of these plants may represent some of the earliest stages in the origins of agriculture whereby such plants were collected or even tended prior to their planting and possible storage. This early strategy of plant use would have predated changes in genetic make-up that are reflected in the process of domestication and its identification in the archaeological plant record (see Ford 1985; King 1985).

Likewise, given that the seeds of these taxa are recovered, one might assume that this plant part (i.e. the seeds) was the part being utilized by humans. However, if one turns to the ethnobotanical record for possible similar uses for these plants, one discovers that it is not the seeds but the leaves or whole plant of all three taxa that are utilized as greens or potherbs and that this is the common link between these taxa. For instance ethnobotanically, species of *Chenopodium* are utilized for numerous purposes including as food, medicine, soap, dye, fragrance and insecticide (Moerman 1998). The seeds, leaves and stems of chenopods are utilized for food. The leaves and stems are usually boiled and eaten alone, with other foods or included in soups. Young plants can also be eaten raw. The leaves are reported to be good sources of vitamins A and C and of potassium and magnesium (Oshodi et al. 1999). For the use of seeds as food, the seeds can be ground and made into a mush; they can be parched, ground, and made into a mush; or they can be ground into flour and made into bread. Seeds are also reportedly stored for winter use by some indigenous groups (Moerman 1998). Purslane is also recorded ethnobotanically as having uses as food and medicine. In the case of purslane the whole plant is usually boiled alone or with meats and eaten. No reference to the use of the seeds of purslane as food was found (Moerman 1998; Gilmore 1977). Leaves, flowers and bulbs of yellow wood sorrel are also known to be used for food with no recorded use of the seeds found. Species of *Oxalis* also have numerous medicinal uses (Moerman 1998).

As such, given the known ethnobotanic use of these three plants as greens, it is possible that these taxa were being utilized for their leaves and whole plant parts as food in the past, as well, and that this practice is being reflected in the archaeological record. The recovery of seeds may only be a by-product of the plants' preparation/ consumption. In the case of the chenopods, the use of the whole plant as greens as opposed to the use only of its seeds may help to explain why *Chenopodium* seeds did not undergo an increase in size as is commonly found in other plants that have undergone domestication (Ford 1985; Smith 1992). A focus and attempt to understand plants which occur in the archaeological record but which are not known domesticates does help to reveal patterns of plant use which may otherwise be missed.

When turning to the results from the analysis of the botanical remains of the Hart Site, a similar pattern of occurrence between chenopods (*Chenopodium* spp.), purslane (*Portulaca oleracea*) and oxalis (*Oxalis stricta*) is noted (Table 2, Figures 2, 3 and 4). Other plant remains recovered (i.e. *Mollugo* spp., *Acalypha* sp., *Euphorbia maculata*) which may be environmental indicators or potential indicators of plant use are also being investigated but are not discussed in the current paper. In particular a few of the surface features yielded botanical remains in sufficient quantity to indicate that certain plant taxa may have been utilized for food by the inhabitants of the Hart Site when the features were constructed. These features are 37, 39 and 40, all located in the upper terrace (T1). The three plant taxa recovered from these features in relatively high numbers and known ethnobotanically to be utilized for food were chenopod (*Chenopodium* sp.) (n=293), purslane (*Portulaca oleracea*)(n=264) and oxalis (*Oxalis stricta*)(n=124)(Table 2, Figures 2, 3, 4, and 5). As previously indicated, these genera are only rarely identified in remains recovered from other sites in Kentucky dated to the Late Archaic. However, seed counts for chenopods do increase through time at various sites in central Kentucky, Tennessee and Illinois, as one enters the Early Woodland time period (see Smith 1992:105, Table 5.1). If the surface features at the Hart Site date to the Woodland period, then the number of *Chenopodium* seeds recovered would not be unusual and in Woodland contexts the recovery of *Chenopodium* remains is usually interpreted as evidence for the use of these plants as food. The chenopod seeds recovered from the Hart Site appear to be non-domesticated based on criteria outlined by Smith (1984, 1992) and Gremillion (1993).

The unusual recovery at the Hart Site of relatively large numbers of carbonized seed remains from the same plant taxa as recovered in association at the Ward Site points to a potential pattern of similar plant use that is focused on wild or non-domesticated plants. The pattern identified appears to indicate that wild plants were frequently utilized as greens or potherbs in the past and that the leaves or whole plant was an important component of indigenous diets. This component is often overlooked in the archaeological record due to a lack of preservation of the plant parts utilized. A misconception that only the seeds of a plant were utilized may have developed since this plant part (i.e. the seeds) is often the only botanical evidence of plant use found archaeologically. The non-domesticated nature of all of these remains also points to the need for more study and attention to plants that are wild or that are not listed commonly as domesticated.

One other plant taxon identified from botanical remains at the Hart Site needs to be discussed in the context of non-domesticates. Though only tentatively identified from Feature 40, a pit-hearth at the Hart Site, four carbonized seeds possibly of Solomon's seal (cf. *Polygonatum* spp. belonging to the Lily family, Liliaceae) were also recovered. Three other carbonized fragments recovered from this feature appear to be rhizome or rootstalks (diameters range from 3 to 3.8 millimeters). One of these has six distinctive scars where the leaf stalks would have broken away. This pattern is found on the rhizome of Solomon's seal, which along with the plant's six pointed flower , gives one of the species in this genus its name (*Polygonatum biflorum*) due to the resemblance to the Star of David, also known as "Solomon's seal" (Bremness 1994). The fragmentary nature of these remains, however, precludes a positive identification, although the potential recovery of members of the Lily family in the archaeological record is important.

The importance of this recovery lies in the fact that the rhizome or tuber of plants of this family were often utilized for food by indigenous groups. Moerman (1998) indicates that the Cherokee used the roots of *Polygonatum biflorum* to make a bread by drying the roots, beating and baking. The plant and leaves were also cooked and eaten as greens and the rhizome was boiled and eaten especially during winter. This potential food source is very rarely discussed in archaeological reports because of the difficulty in recovering tubers from the archaeological record. Only in areas of dry preservation, such as rockshelters, do tubers survive and often these locations may not fit the pattern of where such resources were processed.

The tentative identification of these remains again points to a need to consider non-domesticated plants used for their rhizome or tuber more so when discussing hunter-gatherer and other indigenous groups' activities in North America. This case is even more important when one considers recent studies which illustrate that plant parts rich in inulin, a complex carbohydrate found in numerous bulbs and tubers of the Lily family, are often processed in pit-hearths (Wandsnider 1997). Along with fatty meats and some plants with a high fructan content, inulin-rich tubers are indicated to be the food source cooked most frequently in pit-hearths. Given the identification of this feature type at the Hart Site and many other sites in North America and elsewhere, the use of bulbs, tubers, and rhizomes as food at the site needs to be addressed and incorporated in hypotheses on plant use strategies. As indicated, the recovery of seeds of certain plants may only be a factor of preservation while the actual part utilized (i.e. tuber, leaves) does not preserve. Clearly, a focus only on domesticated plants which are often utilized for their seeds can eliminate a wide range of plants and activities from our discussions of past human behavior.

Conclusions

In conclusion, the botanical remains recovered from the Ward and Hart Sites, located in western and eastern Kentucky, respectively, point to the use of plants which had not undergone domestication. A similar pattern of occurrence of botanical remains found at both sites included the recovery of carbonized seeds from chenopods

(*Chenopodium* spp.), purslane (*Portulaca oleracea*) and yellow wood sorrel (*Oxalis stricta*). The common denominator of use for all three of these taxa is as greens or potherbs in food and the common plant part utilized between all three is for the leaves or whole plant to be cooked or eaten raw. This selection of plant part to be utilized would not lead directly to noticeable evidence in the archaeological record, as these parts do not preserve well. This selection would also not lead to the eventual enlargement of seeds which usually occurs with domesticated species utilized currently and in the past for their seeds (i.e. maize, beans). The multiple uses of the plant parts of chenopods may account for the lack of a trend in the increase in seed size for species of *Chenopodium*. Other plants utilized for their rhizomes or tubers also need to be addressed when recovering seeds which come from plants known ethnobotanically to have such uses (i.e. Solomon's seal, *Polygonatum biflorum*). The seeds, themselves, may not have been the actual plant part utilized. Attention to the use of tubers is especially important given that a likely common function for pit-hearths was to cook tubers that are high in inulin. Such features are often found in the archaeological record and botanical remains that come from tuberous plants need to be addressed in these terms. A discussion of wild and non-domesticated plants, such as purslane and yellow wood sorrel, which receive little attention in the literature may help to better elucidate patterns of human use of plants in the past. These patterns may be lost if attention is only paid to the more commonly discussed domesticated species. As such, there is plenty of room and need for discussion to include the wild and other non-domesticated plants that helped and continue to help to build our human ancestry.

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Table 1. Carbonized Botanical Remains from the Light Fraction Samples and Diversity Indexes for the Ward Site (15McL11)								
Sample No.	F1	F2	F6	F7	F10	F11	F13	Total
Description	Unit A	Unit A	Unit A	Unit B	Unit B	Unit B	Unit B	
	Level 3	Level 3	Level 4	Level 3	Level 3	Level 4	Level4	
	20-30 cm	20-30 cm	30-35 cm	20-30 cm	20-30 cm	30-40 cm	30-40 cm	
Volume (L)	5	5	5.7	4	5	5	5	34.7
Weight of light fraction (g)	2.5	4.4	2.5	2.9	5.8	5.1	12.7	35.9
Weight of heavy fraction (g)	9.8	10.6	4.7	13.6	18.6	21.9	19.8	99
Wood Number	0	0	0	0	1	0	5	6
Wood Weight (g)	0	0	0	0	0.1	0	1.3	1.4
Nutshell Number	0	3	0	0	0	0	2	5
Nutshell Weight (g)	0	0.1	0	0	0	0	0.1	0.2
Aizoaceae *Mollugo* spp.				11	16	12	18	57
Amaranthaceae *Amaranthus* sp.					1			1
Caprifoliaceae cf. *Lonicera* sp.					1			1
Caryophyllaceae *Silene antirrhina*	3	2						5
Chenopodiaceae *Chenopodium* cf. *bushianum**	7	7	1	2	2	1	60	80
Compositae *Eupatorium* cf. *rugosum*					1			1
Cyperaceae *Carex stipata*					1			1
Euphorbiaceae *Euphorbia maculata*	10	5	12	1	2	5		35
Oxalidaceae *Oxalis stricta*	3			1			1	5
Polygonaceae *Polygonum* sp.	1		1					2
Portulacaceae *Portulaca oleracea*	3	4	1	14	9	5	1	37
Rosaceae *Prunus serotina*			1			2		3
Rubiaceae cf. *Galium* sp.		1	1					2
Unidentified type							1	1

Total	27	19	17	29	33	25	81	231
Poaceae rachis						1		1
Flower head					1			1
Uncarbonized seeds	72	50	20	78	68	67	14	369
Insect Remains	10	2	1	1	2	3	9	28
Mollusk Remains	41	34	28	13	24	383	582	1,105
Bone						2	7	9
Diversity Index for seeds/fruits is 0.77								
Diversity Index for nutshell is 0.11								
Diversity Index for seeds/fruits and nutshell is 0.57								

* Remains of *Chenopodium* were complete and fragmented as follows: F1: 3 complete and 4 fragments; F2: 4 complete and 3 fragments; F6: 1 complete; F7: 1 complete and 1 fragment; F10: 1 complete and 1 fragment; F11: 1 fragment; F13: 19 complete and 41 fragments.

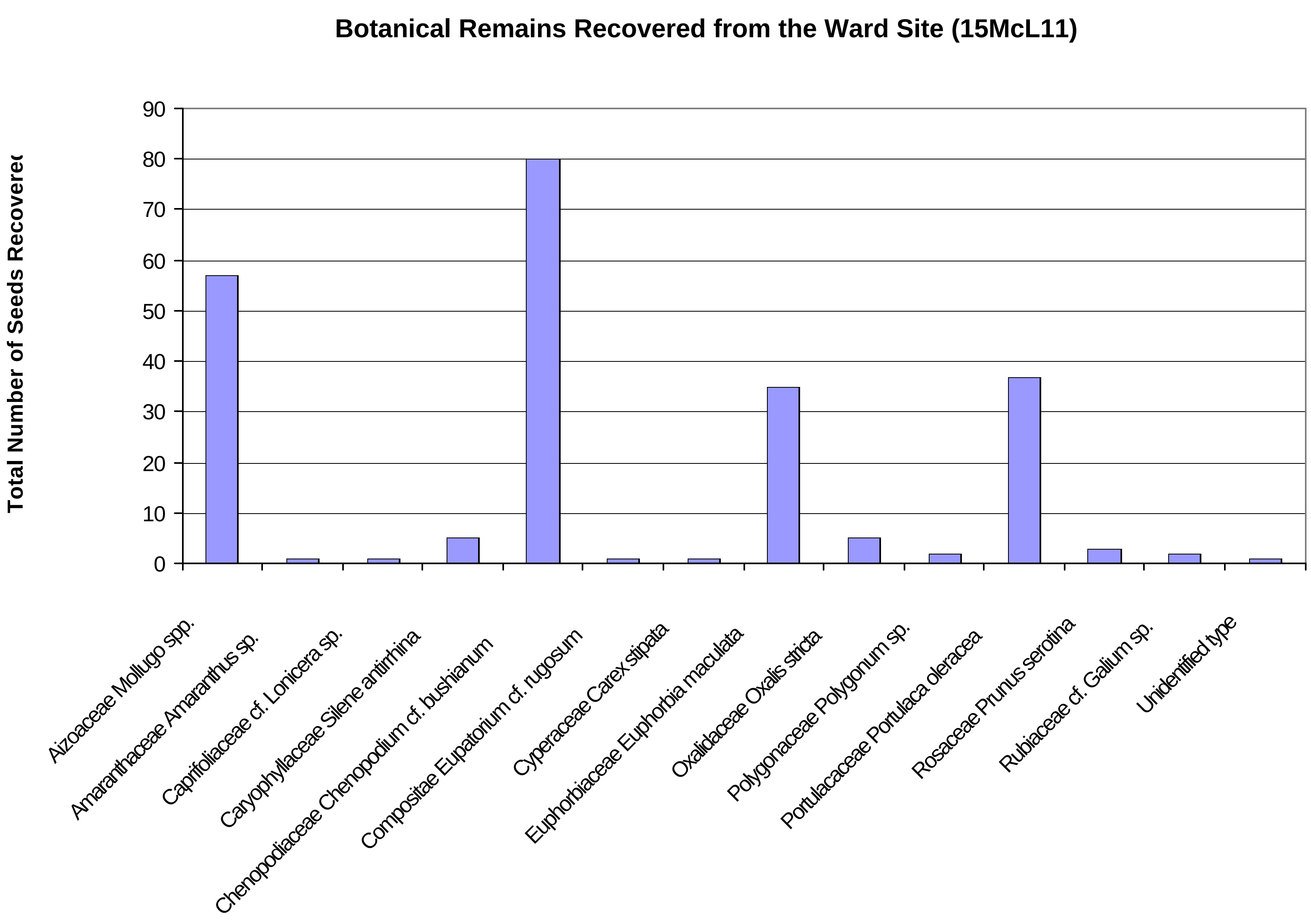

Figure 1. Scientific Identification and Total Number of Seeds Recovered from the Ward Site

Table 2. Carbonized Botanical Remains from the Light Fractions of the Surface Samples and Diversity Indexes for the Hart Site (15La183)																						
Sample No.	F3	F14	F4	F5	F6	F7	F8	F11	F12	F23	F13	F15	F24a	F16	F17	F18	F19	F20	F21	F22	F24	Total
Feature Description	11	11	41	19	21A	25	2	7	18B	18B	29	40	40	38	1	6	P.M. 3	28	47	37	39	
Volume (L)	10	10	10	20	10	10	10	10	10	10	10	10	10	10	20	20	3	10	10	10	10	233
Weight of light fraction (lf)	26	14	14	7	9.6	12	13	8.3	2.7	7.3	17	12	4.4	16	7	13	2.1	38	3.4	9.3	12	248.7
Weight of heavy fraction (hf)	3	4.1	13	0	2.9	2	2.6	3.4	0.4	1.9	0.7	2.1	1.4	509	4	6.4	0.2	6.2	1.6	2.1	12	579
Wood number	63	24	23	19	8	14	57	21	3	7	27	10	5	9	22	39	2	17	16	13	14	413
Wood weight (g)	4	1.3	1	1	0.4	1	3.6	1.7	0.1	0.3	1.1	0.6	0.2	0.3	1	1.6	0.1	0.6	0.5	0.4	0.9	20.3
Nutshell number	3	0	0	0	1	0	0	0	0	0	0	0	0	104	0	0	0	3	0	0	2	113
Nutshell weight (g)	0	0	0	0	0.1	0	0	0	0	0	0	0	0	3.9	0	0	0	0.1	0	0	0.1	4.4
Aizoaceae *Mollugo verticillata*	1	1		4							62		2					48			5	123
Amaranthaceae *Amaranthus* sp.		1											6			1	1			3		12
Caprifoliaceae cf. *Lonicera* sp.													2									2
Sambucus sp.								1							1							2
Caryophyllaceae *Silene antirrhina*				1									20	12			1		3	7	5	49
Stellaria media													1	6	1		1		4		1	14
Chenopodiaceae *Chenopodium* sp.						2					13	16	75	9			6	5		105	62	293*
Compositae													1						1			2
Cruciferae																		1				1
Cucurbitaceae *Cucurbita* cf. *pepo*										1												1
Cyperaceae *Carex aurea*												1										1
cf. *Cyperus* sp.														1								1
cf. Euphorbiaceae	32	10	48	10		10				82	10	8	23	6		4		5	4	38	4	294
Acalypha sp.				6		5					36	3	6	9		299	6	21		12	22	425
Euphorbia sp.													5				8					13
Euphorbia maculata		3		2				1			11		2		1	33	1	3	1	30	3	91

Juglandaceae *Carya* sp.	3				1													3				7
Juglans cf. *nigra*														104							2	106
Labiatae *Lamium* sp.												1	2	3			1					7
Leguminosae				2																		2
Lespedeza sp.						1																1
cf. Liliaceae							1					5	1			1						8
cf. *Polygonatum* spp.												4										4
cf. *Smilacina* sp.												1										1
Oxalidaceae *Oxalis stricta*											4			3				2		114	1	124
Poaceae													3								1	4
Digitaria spp.		1									4		3	16				2	10		1	37
Setaria sp.																					5	5
Polygonaceae *Polygonum* sp.												7		7					3	3		20
Portulacaceae *Portulaca oleracea*	4	8	4	4	3	13	2		2	14	77	3	23	9	1		5	13		33	46	264
Unknown type 1							1															1
Unknown type 2								1														1
Total	40	24	52	29	4	31	4	3	2	97	217	49	175	185	4	338	30	103	26	345	158	1803**
Uncarbonized seeds	1	17	4	7	1	35	10		4	5	599	18	151	44	2	58	12	148	98	94	121	1429
Unidentified carbonized frags.	5	1	1	1								7	3***			2		2				22
Insect remains	5	5		3	1	70	122	228	5	4	6	35	7			1	2	10	8	3	13	528
Mollusk remains			3				9					3	10	3	1		1		3	4	10	47

Diversity Index for seeds/fruits is 0.86.

Diversity index for seeds/fruits/nutshell excluding nutshell from Feature 38 is 0.87.

Diversity Index for seeds/fruits/nutshell including nutshell from Feature 38 is 0.61.

*Includes 236 complete and 58 fragmented specimens of *Chenopodium* sp.

**Total excludes nutshell.

*** Includes three carbonized fragments of roots or rhizomes with leaf scars (diameters range from 3 to 3.8 mm).

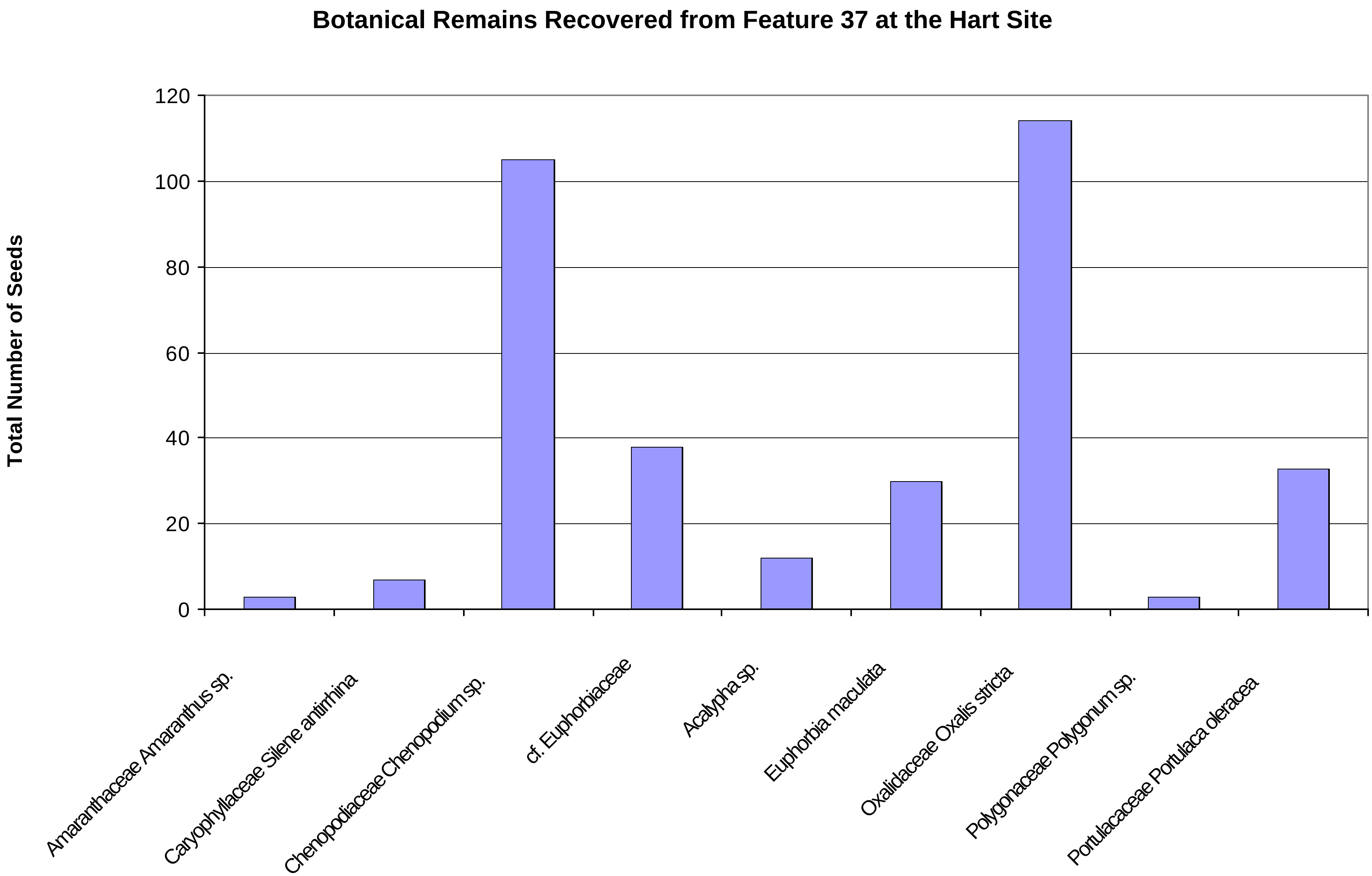

Figure 2. Scientific Identifications and Number of Seeds Recovered from Feature 37 at the Hart Site

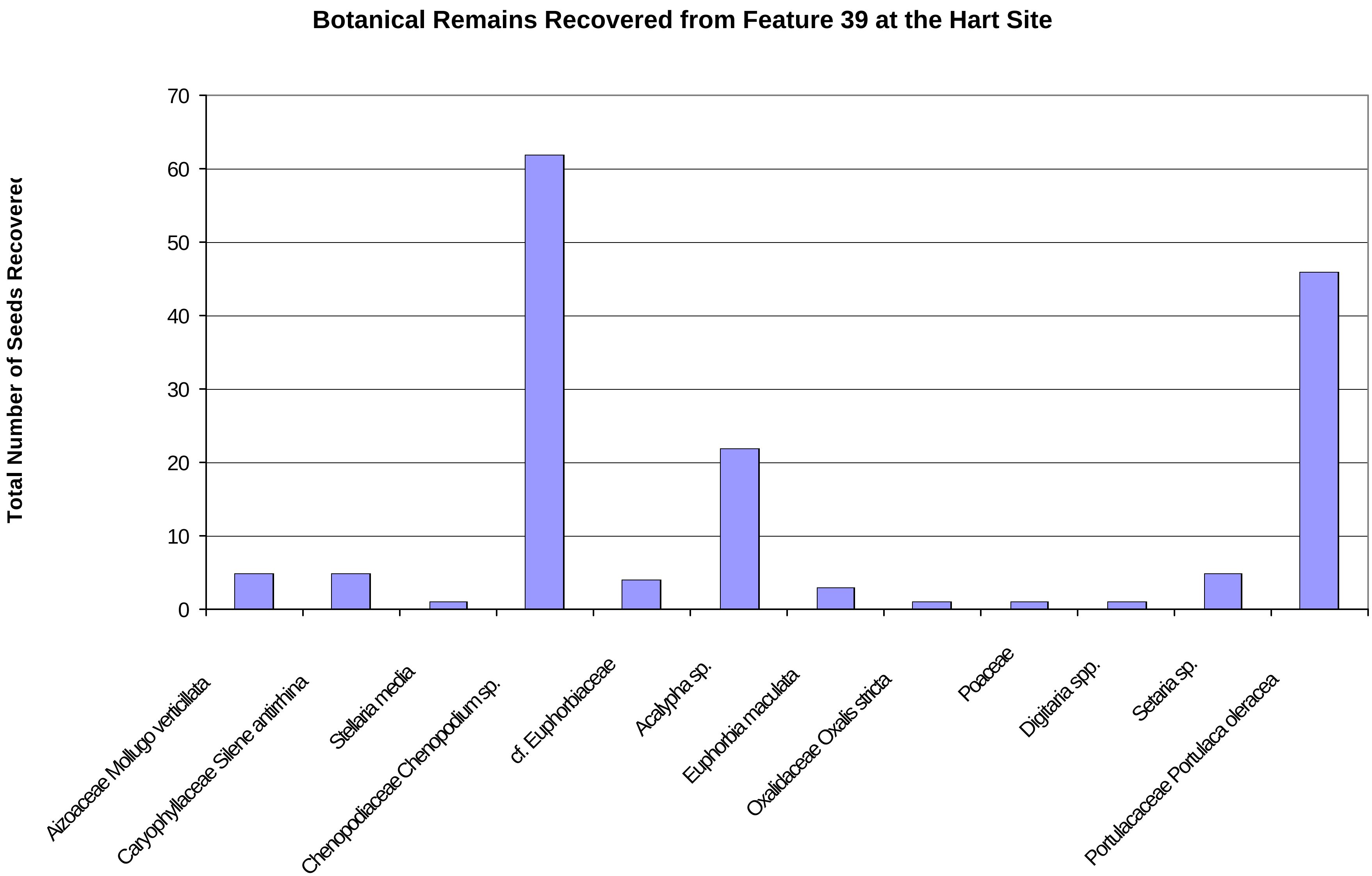

Figure 3. Scientific Identificaitons and Number of Seeds Recovered from Feature 39 at the Hart Site

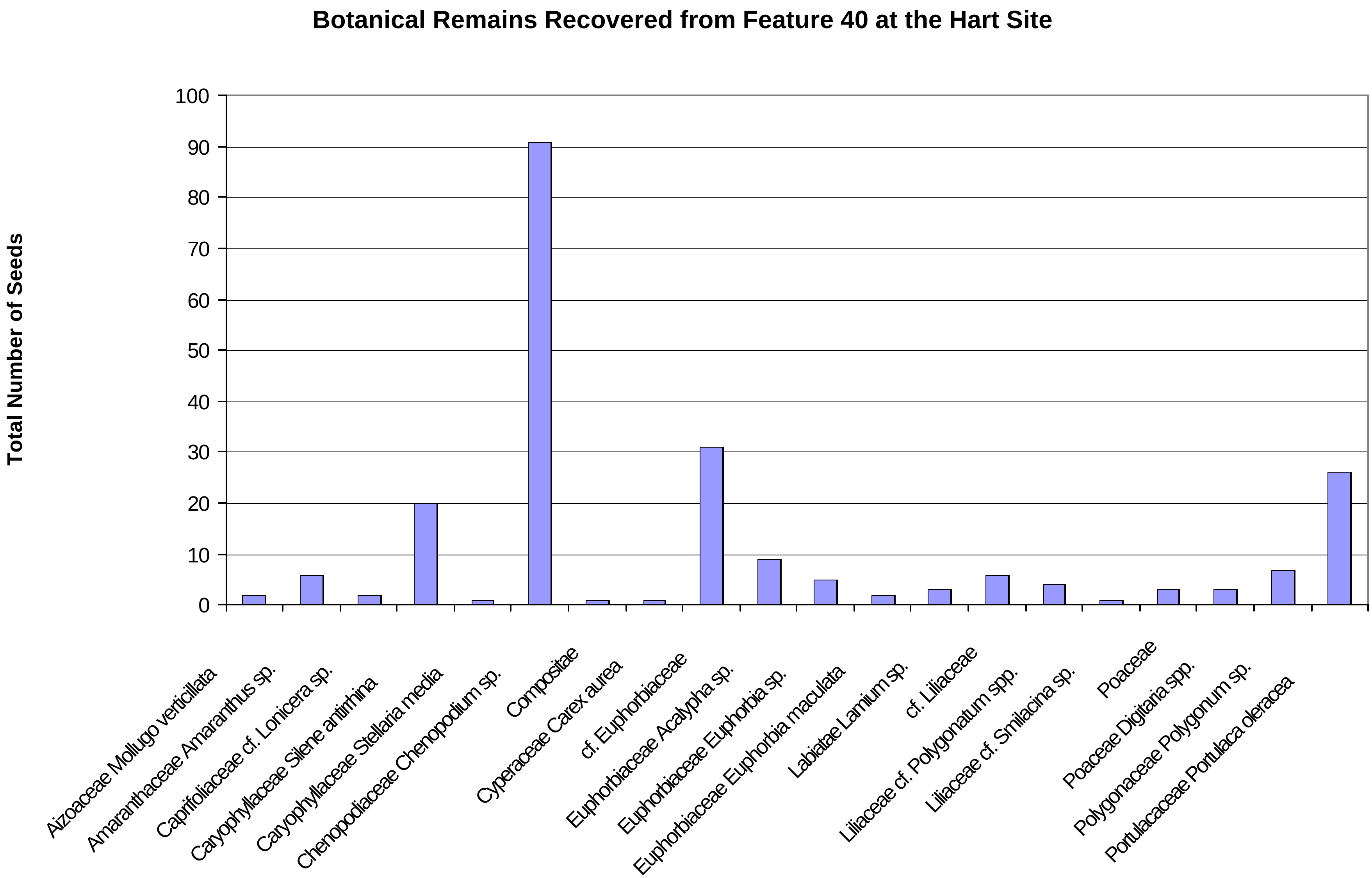

Figure 4. Scientific Idnetifications and Number of Seeds Recovered from Feature 40 at the Hart Site