Identification and management of common cocklebur *(Xanthium strumarium)*

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Introduction and Importance

Common cocklebur *(Xanthium strumarium)* (Figure 1) is a large-seeded erect summer annual broadleaf weed in the Asteraceae family that is native to the Americas and Eastern Asia, found generally along riverbanks, agricultural fields, and other disturbed habitats (Blais & Lechowicz 1989; Weaver & Lechowicz 1983). The large number of seeds produced that are easily spread due to their ability to float and stick to animals and humans can cause common cocklebur to easily become a dominant species in an area (Rojas-Sandoval 2007). Due to the competitive nature, common cocklebur competes with crops for essential resources like water, nutrients, and sunlight which can potentially reduce crop yields. One to three common cocklebur plants per ten square feet can cause soybean yield losses of 52-75% (Weaver & Lechowicz 1983). Common cocklebur is not as competitive in corn as it is in soybean but can still cause significant yield losses (Weaver 2001). In a study done by Nakova et al. (2004), the presence of common cocklebur negatively impacted corn growth at the V4 to V5 growth stages, as well as overall grain yield. Beyond the direct yield losses caused by competition, common cocklebur infestation also degrades seed quality by increasing foreign matter and seed moisture content (Nakova et al. 2004).

Figure 1. Mature common cocklebur plant. Photo courtesy of Jan Samanek, Phytosanitary Administration, bugwood.org.

Common cocklebur emergence occurs in mid-spring to early summer, with seedlings occasionally appearing later in the summer as well (Bararpour & Oliver 1998). Under no-till conditions, emergence is more evenly distributed from late spring throughout summer compared to tilled conditions (Norsworthy & Oliveira 2007). Common cocklebur is monoecious, meaning that a plant has both male and female reproductive organs; therefore, only one plant is needed to produce seeds. The seeds are produced inside of a bur (hence the name), with each bur normally containing two seeds, one larger and one smaller (Mohler et al. 2021). Each plant can produce 500 to 5,400 burs (Weaver & Lechowicz 1983), but this depends on the size of the plant at the time flowering begins (Mohler et al.

2021). The seeds undergo a phenomenon known as heteromorphic seed germination (Wang et al. 2010), where the larger of the two seeds will germinate the first year, and the smaller seed usually germinating after two or more seasons (Abler 1950). The dormancy of the smaller seed is due to the inability of oxygen to pass through the seed coat (Mohler et al. 2021). Seed heteromorphism is generally believed to be crucial for avoiding the negative effects of crowding (when a large number of plants are together in a restricted area), reducing competition, and adapting to various environmental conditions (Wang et al. 2010). The plant is drought-tolerant, with roots extending seven feet laterally and four feet deep, enabling access to water throughout the soil profile (Weaver & Lechowicz 1983). The ability to absorb more water than other crops or weeds under similar conditions makes the plant an aggressive competitor. In high nitrogen conditions, common cocklebur will store excess nitrate and later use it to increase seed production (Weaver & Lechowicz 1983).

Identification

Common cocklebur is often confused with common burdock *(Arctium minus)* (Figure 2), spiny cocklebur *(Xanthium spinosum)* (Figure 3), and common sunflower *(Helianthus annuus)* (Figure 4). The main differences between these species are:

Figure 2. Mature common burdock plant. Photo courtesy of Anthony D. White, The Ohio State University, bugwood.org.

Figure 3. Mature spiny cocklebur plant. Photo courtesy of Barry Rice, sarracenia.com, bugwood.org

Figure 4. Common sunflower plant before flowering. Photo courtesy of Theodore Webster, USDA Agricultural Research Service, bugwood.org.

Common cocklebur

- Common cocklebur has large, broad leaves (up to 8 in long, up to 3 in across) with three or five lobes with irregularly toothed margins (Figure 5) (Rojas-Sandoval 2007)
- Both leaf surfaces are green and rough (Rojas-Sandoval 2007)
- Stems do not have any spines (Rojas-Sandoval 2007)
- Relatively large fruit (0.25 to 1 in long) topped with two distinct points (Figure 6) (Rojas-Sandoval 2007)

Figure 5. Common cocklebur leaves and stems. The entire plant is rough to the touch.

Figure 6. Common cocklebur fruits. Each bur contains two seeds, one that germinates in the first year and one that is dormant until at least the following year. Photo courtesy of John M. Randall, The Nature Conservancy, bugwood.org.

Common burdock

- Larger leaves (20 in by 16 in) with wavy margins (Figure 7) (Mohler et al. 2021)
- Burs separate into individual spined fruits (Figure 8) (Mohler et al. 2021)

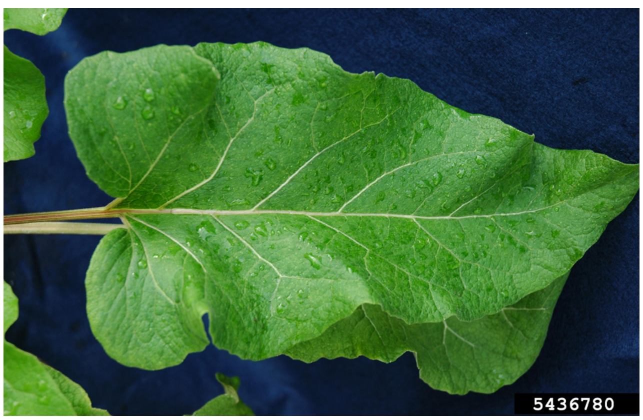

Figure 7. Common burdock leaf. Photo courtesy off Bruce Ackley, The Ohio State University, bugwood.org.

Figure 8. Common burdock bur/flower. Photo courtesy of Becca MacDonald, Sault College, bugwood.org.

Spiny cocklebur

- Small to moderately-sized, narrow leaves (1 to 4 in long, 0.2 to 1.2 in wide) with three irregular lobes (Figure 9) (Rojas-Sandoval 2007)
- Leaves have dark green upper surface, whitish colored undersides (Rojas-Sandoval 2007)
- Stems have three-pronged spines near the base (Figure 10) (Rojas-Sandoval 2007)
- Moderately-sized fruit (0.3 to 0.75 in long) that can sometimes be topped with two smaller points (Figure 11) (Rojas-Sandoval 2007)

Figure 9. Spiny cocklebur leaves. Photo courtesy of Robert Videki, Doronicum Kft., Bugwood.org.

Figure 10. Spiny cocklebur stem. Photo courtesy of John M. Randall, The Nature Conservancy, bugwood.org.

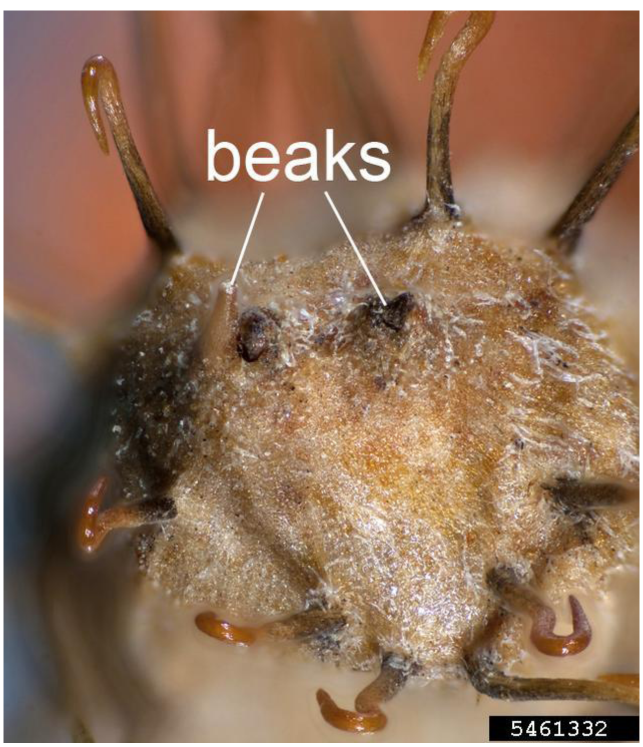

Figure 11. Spiny cocklebur fruit. Photo courtesy of D. Walters and C. Southwick, Table Grape Weed Disseminule ID, USDA APHIS PPQ, bugwood.org

Common sunflower

- Leaves are heart-shaped, triangular, or lanceolate with long petioles (4 to 12 in long) (Figure 12)
- Rough stems and leaves

Figure 12. Common sunflower leaves. Photo courtesy of Howard F. Schwartz, Colorado State University, bugwood.org.

Common cocklebur grows to height of 0.5 to 6.5 feet tall. The large, linear to oblong waxy cotyledons are a distinguishing feature of this weed during its early growth stages. The first true leaves are arranged oppositely, while all following leaves are alternate (Figure 13). These leaves are triangular to ovate in shape, covered in stiff hairs, and measure about two to six inches in length. The leaves are irregularly lobed with margins that have relatively subtle teeth. The flowers of common cocklebur flowers are small and greenish and emerge from the area between the leaf petioles and the stems, as well as at the tips of the upright stems. The female flowerheads are yellow-green and oblong, while the male flowers are smaller and rounder. The female flowerheads develop into hard, brown seed capsules that have stiff burs (Pitcher 1989).

Figure 13. Common cocklebur seedling. Photo courtesy of Phil Westra, Colorado State University, bugwood.org.

Cultural and Mechanical tactics

The ability to emerge from relatively deep depths and rapid growth of common cocklebur facilitate survival to tine and rotary weeding (Mohler et al. 2021). Under tillage, the plant emerges quicker and in larger numbers (Norsworthy & Oliveira 2007) and is more competitive (Bararpour & Oliver 1998). Interrow cultivation early and close to the row as well as repeating the process regularly until the crops are too large to allow for tractor traffic can be effective. If plants set seed before harvest, ensure that the seeds are collected or destroyed before combining (Mohler et al. 2021). Rotating to a winter crop (i.e., winter wheat) can be beneficial, as the burs do not mature by the time of grain harvest and have ground cover before seeds emerge.

According to Weaver and Lechowicz (1983), young common cocklebur plants can readily regrow from the lower nodes if injured or clipped. Even if older plants or shoots are cut or damaged, the fruit can still mature as long as pollination occurred before the injury. Burs may remain on dead plants for up to 12 months (Parsons 1973). To prevent resprouting from the shoot bases and subsequent seed production, disk the field and plant a cover crop after the grain harvest (Mohler et al. 2021). Mowing can be an effective tactic for young plants but is not an effective control method for mature common cocklebur plants because the plants can regrow. Hand pulling or hoeing the plants is an effective control measure if done before flowering (Parsons 1973).

Due to the seeds and vegetation containing diterpene glycoside, a toxic glycoside that can be fatal to livestock if ingested, grazing is not considered an effective control option. This toxic glycoside causes an acute metabolic disorder, dropping blood glucose levels suddenly and increasing certain liver enzymes. Ingestion of seedlings at 1% body weight or more can be fatally toxic to livestock, especially pigs and calves (Ditomaso et al. 2013).

Chemical tactics

Herbicides are the main tactic to manage common cocklebur. Overreliance has selected for herbicide-resistant biotypes. Populations resistant to ALS-inhibitors have been reported in the United States, as well as the rarely-used arsenical herbicide DSMA (Heap 2005; Hoagland et al. 2005; Haigler et al. 1988). Resistance as described above increases the difficulty of managing common cocklebur with herbicides. Since common cocklebur possesses large seeds, many pre-emergence herbicides are not effective. PPO-inhibitors (Group 14) and HPPD-inhibitors (Group 27) are likely the more effective pre-emergence options. Pre-emergence ALS-inhibitors are effective as well if resistance is not present. More herbicide options are available post-emergence. Auxin type herbicides (Group 4), glufosinate (Group 10), PPO-inhibitors, and HPPD-inhibitors are effective. Since herbicide resistance is an issue other weed species, herbicides should be used in a manner that reduces selection pressure. Do not rely solely on one or two herbicide groups to manage ragweed. Utilizing a pre- and post-emergence herbicide program and applying at least two different herbicide groups in each application will reduce selection pressure on resistant weeds and increase the spectrum of weeds managed. Crop rotation will also allow the utilization of different herbicide groups. Tables 1 and 2 provide an overview of effective herbicides to manage common cocklebur in corn and soybean, respectively. Refer to the SDSU Extension Pest Management Guides for a more detailed herbicide (and pesticide) list for various crops (extension.sdstate.edu/south-dakota-pest-management-guides).

Table 1. Effective herbicide chart for chemical control of common cocklebur in corn.

Group	Site/MOA	Example	Application Timing
2	ALS inhibitor	halosulfuron (Permit)	Post
4	Growth regulator	2,4-D, dicamba (Clarity/DiFlexx, Stinger)	Post
5	Photosynthesis inhibitor (triazine, triazinone)	atrazine, metribuzin	Pre/Post
6	Photosynthesis inhibitor (contact)	bentazon (Basagran), bromoxynil (Bromoxynil)	Post
9	EPSP inhibitor*	glyphosate (Roundup)	Post
10	Glutamine synthase inhibitor*	glufosinate (Liberty)	Post
14	PPO inhibitor	saflufenacil (Sharpen)	Pre
27	HPPD inhibitor	mesotrione (Callisto), tembotrione (Laudis), topramezone (Impact/Armezon)	Pre/Post
*Crop variety must be tolerant to the herbicide.			

Table 2. Effective herbicide chart for chemical control of common cocklebur in soybean.

Group	Site/MOA	Example	Application Timing
2	ALS inhibitor	chlorimuron (Classic), cloransulam (FirstRate), halosulfuron (Permit), imazamox (Raptor), imazethapyr (Pursuit)	Pre/Post
6	Photosynthesis inhibitor (contact)	bentazon (Basagran)	Post
9	EPSP inhibitor*	glyphosate (Roundup)	Post
10	Glutamine synthase inhibitor*	glufosinate (Liberty)	Post
14	PPO inhibitor	flumioxazin (Valor), fomesafen (Flexstar/ Reflex), lactofen (Cobra/Phoenix)	Pre/Post
*Crop variety must be tolerant to the herbicide.			

Common Natural Enemies and Secondary Hosts

Common cocklebur has several natural enemies. Moths *(Phaneta imbridana)* lay eggs on the bur wall, where the larvae will bore into it and consume the seeds (Mohler et al. 2021). Similarly, a species of fruit fly (Euaresta aequalis) punctures the bur wall to deposit its eggs directly on the developing seeds (Hare 1977). Seed mortality is heavily influenced by the characteristics of the bur. For example, longer spines deter the fly, while thicker walls deter the moth (Hare 1980). Additionally, two species of stem beetle, Dectes stem borer *(Dectes texanus)* (Figure 14) and Red Cocklebur Weevil *(Rhodobaenus quinquepunctatus)* (Figure 15) (Anderson 2002; Michaud et al. 2007; Vaurie 1980; Vauri 1981; Weiss & Lott 1923), burrow into the stems and overwinter in the roots, impacting seed production only in the branches they damage (Weaver & Lechowicz 1983). The rust fungus, Puccinia xanthii (Figure 16), causes deformed leaves, premature leaf shedding, stem cracks, reduced plant size, and weakened seed viability by attacking all parts of the plants except for the flowers (Weaver & Lechowicz 1983).

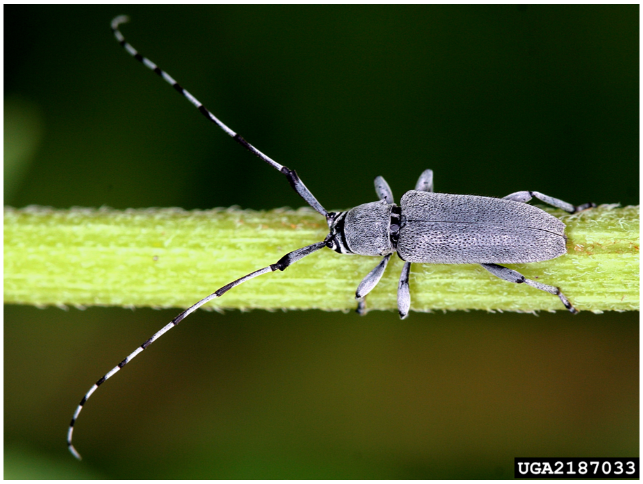

Figure 14. Dectes Stem Borer. Photo courtesy of David Cappaert, bugwood.org.

Figure 15. Red Cocklebur Weevil. Photo courtesy of Kansas Department of Agriculture, bugwood.org.

Figure 16. Cocklebur rust, *Puccinia xanthii*. Photo courtesy of Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, bugwood.org.

Conclusion

Common cocklebur is a resilient and widespread weed known for its spiny seed burs and ability to thrive in diverse environments. It spreads effectively by hitching rides on animals, humans, and machinery, allowing it to invade new areas rapidly. While it plays a role in some of these areas, such as providing food for certain wildlife, common cocklebur's aggressive growth allows it to outcompete native vegetation, reduce biodiversity, and impact crop yields, particularly in soybean and corn fields. Additionally, its toxic seeds and seedlings pose a risk to livestock when ingested. Effective management strategies, including prevention, early detection, and timely control methods, are essential to minimize its impact on crops, pastures, and natural areas. By understanding its life cycle and ecological effects, landowners and farmers can take proactive measures to reduce the spread of this weed.

References

Abler, C. P. (1950). *A study of the common cocklebur* (Electronic Theses and Dissertations, 2198). South Dakota State University. Retrieved from https://openprairie.sdstate.edu/etd/2198/

Anderson, R. S. (2002). Chapter 131. Curculionidae. In *American beetles* (Vol. 2, pp. 722-815). CRC Press.

Bararpour, M. T., & Oliver, L. R. (1998). Effect of tillage and interference on common cocklebur *(Xanthium strumarium)* and sicklepod *(Senna obtusifolia)* population, seed production, and seedbank. *Weed science, 46*(4), 424-431.

Blais, P. A., & Lechowicz, M. J. (1989). Variation among populations of *Xanthium strumarium* (Compositae) from natural and ruderal habitats. *American Journal of Botany, 76*(6), 901-908.

DiTomaso, J. M., Kyser, G. B., Oneto, S. R., Wilson, R. G., Orloff, S. B., Anderson, L. W., ... & Mann, J. J. (2013). Weed control in natural areas in the western United States. *Weed Research and Information Center, University of California, 544.*

Haigler, W. E., Gossett, B. J., Harris, J. R., & Toler, J. E. (1988). Resistance of common cocklebur *(Xanthium strumarium)* to the organic arsenical herbicides. *Weed Science, 36*(1), 24-27.

Hare, J. D. (1977). The biology of *Phaneta imbridana* (Lepidoptera: Tortricidae), a seed predator of *Xanthium strumarium* (Compositae). *Psyche: A Journal of Entomology, 84,* 179-182.

Hare, J. D. (1980). Variation in fruit size and susceptibility to seed predation among and within populations of the cocklebur, *Xanthium strumarium* L. *Oecologia, 46,* 217-222.

Heap, I. M. (2005). Criteria for confirmation of herbicide-resistant weeds. *International survey of herbicide-resistant weeds.* Retrieved from https://www.weedscience.org/

Hoagland, R. E., Boyette, C. D., Weaver, M. A., & Abbas, H. K. (2005). Research findings and strategies to reduce risks of the bioherbicide, *Myrothecium verrucaria.* In *Proceedings of the International Allelopathy Congress* (Vol. 3, pp. 114-121).

Michaud, J. P., Qureshi, J. A., & Grant, A. K. (2007). Sunflowers as a trap crop for reducing soybean losses to the stalk borer Dectes texanus (Coleoptera: Cerambycidae). *Pest Management Science: formerly Pesticide Science, 63*(9), 903-909.

Mohler, C. L., Teasdale, J. R., & DiTommaso, A. (2021). *Manage weeds on your farm: A guide to ecological strategies.* Sustainable Agriculture Research and Education.

Nakova, R., Baeva, G., & Nikolov, P. (2004). Competition between maize and *Xanthium strumarium* L. *Pesticidi i fitomedicina, 19*(4), 257-263.

Norsworthy, J. K., & Oliveira, M. J. (2007). Tillage and soybean canopy effects on common cocklebur *(Xanthium strumarium)* emergence. *Weed Science, 55*(5), 474-480.

Parsons, W. T. (1973). *Noxious weeds of Victoria* (pp. 311-pp). Government Printer.

Pitcher, D., & Team, G. I. S. (1989). TNC/*Xanthium strumarium. NATURAL HISTORY, 1,* 1.

Rojas-Sandoval, J. (2007). *Xanthium strumarium* (common cocklebur). *Forest.*

Vaurie, P. (1980). Revision of *Rhodobaenus*. Part 1, Species in South America (Coleoptera, Curculionidae, Rhynchophorinae). *Bulletin of the American Museum of Natural History, 167*(1).

Vaurie, P. (1981). Revision of *Rhodobaenus*. Part 2, Species in North America (Canada to Panama) (Coleoptera, Curculionidae, Rhynchophorinae). *Bulletin of the American Museum of Natural History, 171*(2).

Wang, L., Dong, M., & Huang, Z. Y. (2010). Review of research on seed heteromorphism and its ecological significance. *Chinese Journal of Plant Ecology, 34*(5), 578.

Weaver, S. (2001). *Cocklebur, Factsheet.* Ministry of Agriculture, Food and Rural Affairs, Ontario.

Weaver, S. E., & Lechowicz, M. J. (1983). The biology of Canadian weeds: 56. *Xanthium strumarium* L. *Canadian Journal of Plant Science, 63*(1), 211-225.

Weiss, H. B., & Lott, R. B. (1923). Notes on *Rhodobaenus 13-punctatus* (Ill.), the cocklebur billbug (Col.). *Entomological News, 34,* 103-106.

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